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Essays on Fiscal Policy in OECD and Developing Countries

Essais sur la Politique Budgétaire dans les Pays de l'OCDE et les Pays en Développement

Thèse Nouveau Régime

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SUMMARY

The issue of financing development in developing countries is at the heart of this thesis. The latter revolves around **four chapters** on financing development related matters. The **chapter 1** explores how fiscal episodes in the main traditional OECD (Organization for Economic Cooperation and Development) donors affect their supply of development aid towards developing countries. Evidence is shown that fiscal episodes affect significantly aid supply, with a behavioural difference between European Union and Non-European countries in terms of aid supply. The **chapter 2** deals with the consequences of development aid unpredictability and migrants' remittances on fiscal consolidation in developing countries. We find evidence that while migrants' remittances exert a positive and significant effect on the likelihood of fiscal consolidation in developing countries, development aid unpredictability does not. These results particularly suggest that a better management of the revenues derived from these private transfers during their booms could help avoid such situations and allow greater room of maneuver for governments' recipients to implement countercyclical measures during bad times. The **chapter 3** investigates whether the structural vulnerability of developing countries matters for their public indebtedness and evidence is obtained that it does. More specifically, we observe the existence of U-curve relationship between this structural vulnerability and the total public debt of these countries. Focusing on the specific case of CFA Franc Zone countries in **chapter 4**, we examine the relationship between the structural vulnerability and the probability of entering into excessive public debt. We also obtain evidence of a nonlinear effect of the structural vulnerability indicator with respect to the probability of entering into excessive debt: a rise in the structural vulnerability of these countries increases their probability to engage into excessive debt; however this probability declines after a certain threshold of their structural vulnerability. These results (both for developing countries and particularly for CFA Franc Zone countries) suggest that international development institutions such as the World Bank and International Monetary Fund (IMF) should take into account such vulnerability in their assessment of the adequate development policies and recommendations - especially those related to debt issues -, to these countries.

Keywords: Foreign development aid, fiscal episodes, remittances, aid unpredictability, structural vulnerability, public debt, OECD, Developing Countries, CFA Franc Zone countries.

RESUME

La problématique du financement du développement dans les pays en développement se trouve au cœur de cette thèse. Cette dernière s'articule autour de **quatre chapitres** sur les questions liées au financement du développement. Le **chapitre 1** explore les effets des épisodes budgétaires dans les principaux pays donateurs principaux de l'OCDE (Organisation pour la Coopération et le Développement Economique) sur leur offre d'aide au développement aux pays en développement. On observe que les épisodes budgétaires affectent significativement l'offre d'aide, avec une différence comportementale en termes d'offre d'aide du groupe de pays de l'Union européenne versus le groupe de pays de l'OCDE n'appartement pas à L'Union européenne. Le **chapitre 2** s'intéresse aux conséquences des transferts des migrants et de l'imprévisibilité de l'aide au développement sur la probabilité de consolidation budgétaire dans les pays en développement. Les résultats montrent que les transferts des migrants affectent positivement et significativement cette probabilité alors que l'effet est statistiquement nul pour l'imprévisibilité de l'aide. Ces résultats suggèrent en l'occurrence qu'une meilleure gestion des recettes issues de ces transferts durant les périodes de boom économique pourrait aider à éviter de telles situations et offrir une marge de manœuvre plus importante à ces gouvernements pour la mise en œuvre de politiques contra-cycliques pendant les périodes de basse conjoncture. Le **chapitre 3** analyse l'existence ou non d'effet de la vulnérabilité structurelle des pays en développement sur leur dette publique totale. Les résultats suggèrent qu'un tel effet existe: en l'occurrence, on montre l'existence d'une relation en forme de 'U' entre la vulnérabilité structurelle de ces pays et leur dette publique totale. En focalisant dans le **chapitre 4** sur les pays de la zone Franc CFA, nous examinons si leur vulnérabilité structurelle conduit les gouvernements à un endettement excessif. Les résultats suggèrent que plus ces pays sont vulnérables, plus ils sont enclins à un endettement excessif et qu'au-delà d'un seuil de vulnérabilité, leur probabilité d'endettement excessif diminue. Ces résultats obtenus aussi bien pour l'ensemble des pays en développement que pour les pays de la zone Franc CFA suggère que les Institutions Internationales telles que la Banque Mondiale et le Fonds Monétaire International (FMI) devront prendre en compte cette vulnérabilité dans l'évaluation des politiques de développement ainsi que leurs recommandations – en particulier sur les questions liées à l'endettement – pour ces pays.

Mots-clés: Aide publique au développement, épisodes budgétaires, transferts des migrants, imprévisibilité de l'aide, vulnérabilité structurelle, dette publique, OCDE, Pays en Développement, Pays de la zone Franc CFA.

GENERAL INTRODUCTION

The financing development issue remains a major concern for developing countries (DCs), especially the poorest among them – least developed countries (LDCs). These countries could finance their development needs by resorting to several sources, one of which is overseas development aid (ODA), which includes indebtedness vis-à-vis multilateral institutions; indebtedness vis-à-vis private banks in the international financial market; migrants' remittances, etc. The exposure of these countries and specifically LDCs to internal and external shocks increases proportionately to their financing needs. The issue of financing development is at the heart of this thesis: we first explore how fiscal policy in OECD (Organisation for Economic Co-operation and Development) countries and in DCs is related to their financing sources, namely ODA and migrants' remittances. Second, we assess the way in which structural economic vulnerability affects developing countries' public debt.

In the **first part** of the thesis, we examine in **Chapter I** the effects of 'large' fiscal austerity measures in OECD donor countries (developed countries) on their aid supply and in **Chapter II** the impact of ODA's unpredictability and migrants' remittances on the probability of developing countries adopting fiscal austerity measures.

In fact, the strains on developed countries' public finances, fuelled by the 2008 financial crisis and the subsequent debt crisis in European countries, have once again raised the question of financing development in developing countries, mainly through ODA. In this respect, this thesis questions how fiscal austerity measures in the main OECD donor countries affect their aid supply.

In addition, as mentioned previously, migrants' remittances, defined by Ratha (2003) as the 'unrequited, non-market personal transfers between households across countries', are an important source for these countries to finance their development. Therefore, we question whether these transfers exert an effect on the fiscal adjustment measures adopted by these countries.

The economic literature has largely established that one of the main characteristics of developing countries and specifically LDCs is their structural vulnerability. Guillaumont (2009) and Guillaumont and Cariolle (2011) define the latter as 'the risk of a (poor) country seeing its development hampered by the natural and external shocks it faces'. Moreover, this indicator is used, amongst others, by the United Nations as one of the criteria for identification and graduation of least developed countries (LDCs). Many studies have shown

the need to use this indicator to examine the aid allocation criteria (see, e.g., Guillaumont, 2008; Guillaumont, 2013; Guillaumont et al, 2013). However, this literature has not dealt with the impact of this vulnerability on the public indebtedness of developing countries. In this thesis, we try to fill this gap by examining the impact of the developing countries' structural vulnerability on their public debt. We further investigate the effect of the structural vulnerability of CFA Franc Zone countries on their probability of engaging in excessive public debt.

Fiscal Episodes and Official Development Aid Supply: The majority of developed donor countries have engaged in 'severe' fiscal austerity further to the deterioration of their public finances, the latter being exacerbated by the recession induced by the 2008 financial crisis and the medium- to long-run effect of population aging. The economic literature on fiscal policy choices and their economic consequences is large (see, e.g., Alesina & Perotti, 1995, 1997a; IMF, 1996, 2010; McDermott & Wescott, 1996; OECD, 1997; Perotti, 1997; Alesina & Ardagna, 1998; Alesina, Perotti & Tavarez, 1998; Heylen & Everaert, 2000; Ardagna, 2007; Alesina & Ardagna, 2010). All these authors, with the exception of Heylen and Everaert (2000), convey the same message: 'fiscal adjustments, which rely primarily on spending cuts, that is, cuts on transfers and on the government wage bill have a better chance of being successful and are expansionary'. Alesina and Ardagna (2010) also provide evidence that fiscal adjustments that rely primarily on tax increases and cuts in public investment tend not to last and are contractionary. Heylen and Everaert (2000) empirically contest the result according to which current expenditure reductions, especially the government wage bill are the best policy to achieve successful fiscal consolidation. According to them, the likelihood of successful consolidation rises if consolidation rises if among others, consolidation relies on cutting transfers or on raising direct taxes on business, or if it does neither rely on raising taxes on households and labour, nor on cutting government investment or more specifically if (in contrast with one of Alesina and Perotti's and McDermott and Wescott's most popular hypotheses) it does not rely on cutting the government wage bill.

Although the economic literature has focused on the economic consequences of fiscal episodes in OECD members, to our knowledge no study has examined the effects of these episodes on their official development aid supplies, even though a few studies have explored the impact of fiscal policies in OECD countries on aid expenditure. Interestingly, these few studies have not led to converging results in terms of ODA's impact of fiscal policies: for

example, Faini (2006) finds evidence that a higher budget deficit and higher stock of public debt reduce aid, whereas Round and Odedokun (2004) and Boschini and Olofsgard (2007) find no significant relationship between deficits and aid provision. Moreover, none of these studies explore the effects that fiscal episodes in donor countries may have on aid provision.

The objective of this chapter is to investigate how donors behave in terms of supplying aid during fiscal episodes. In other words, we explore the long-run average (LRA) effects of fiscal consolidation and stimuli episodes on OECD donor countries' aid supplies, irrespective of their effect on per capita income, and other economic, political, institutional and international political economy variables.

***ODA unpredictability, migrants' remittances and fiscal adjustment in developing countries*:**

The issue of the consequences of fiscal episodes and particularly fiscal austerity measures in developing countries has been the subject of the economic literature. The latter encompasses two main strands: the impact of fiscal consolidation measures on macroeconomic variables such as growth, investment, savings, etc. and the determinants of fiscal consolidation. Whereas the first strand of this empirical literature has been largely explored for both developed and developing countries, the second strand, apart from certain scarce studies (such as Larvigne, 2010), has focused mainly on developed countries.

Remittances are considered as an increasingly important source of external funding for a number of developing countries, exceeding the levels of foreign aid or foreign direct investment (see, e.g., IMF, 2005; World Bank, 2006; Chami et al, 2008; Ratha, 2009). Moreover, many scholars, including Ratha (2005), argue that these remittances represent a stable source of funding for development, whereas ODA flows have been considered as unpredictable (see Vargas Hill, 2005; Celasun & Walliser, 2008), in reference to Paris's declaration on aid effectiveness.

On one hand, researchers such as Chami, Cosimano and Gapen (2006) provide evidence that remittances, by increasing consumption, expand the revenue base and thus allow the government to carry more debt or incur more expenditure. On the other hand, Gemmell and McGillivray (1998) show that development aid flows' unpredictability is associated with reductions in government spending and/or increases in taxes. In this respect, this chapter investigates the impact of migrants' remittances and the unpredictability of ODA on fiscal adjustment in developing countries.

The second part of the thesis deals with the consequences of the structural vulnerability of developing countries for their public indebtedness. In this respect, **Chapter III** explores the impact of structural vulnerability of developing countries on their public debt and **Chapter IV** focuses on the specific case of CFA Franc Zone countries to assess whether or not structural economic vulnerability influences their excessive indebtedness.

Structural vulnerability and public indebtedness in developing countries: Is the structural economic vulnerability of developing countries a major determinant of their public debt? Developing countries have in general been prone to several types of shocks, such as shocks to international commodity prices, natural disasters, conflict-related shocks, global financial market shocks, shocks to international interest or exchange rates, shortfalls in external aid flows, changes in host country policies for migrant labour, etc.

According to the World Bank classification, the developing countries group – which is different from that of high-income countries – is heterogeneous and includes low-income countries (LICs) and middle-income countries (MICs) (which include lower-middle income countries – LMICs – and upper-middle-income countries – UMICs). While high-income countries are highly exposed to market development as well as natural disaster shocks, UMICs have greater access to market-related financing and LICs and LMICs have limited access to private financing. Many LICs and LMICs have, in fact, benefited from substantial debt cancellation under international schemes, such as the heavily indebted poor countries (HIPCs) initiative and the multilateral debt relief initiative (MDRI). However, despite these initiatives, the debt problem persists (see, e.g., Christensen, 2005; Rocher, 2007; and Cabrillac & Rocher, 2009 for the case of sub-Saharan Africa). In addition, Guillaumont (2006) and UNDP (2010), for example, highlight that the greater vulnerability to high levels of public debt is owed to a range of structural weaknesses of developing countries, particularly the poorest ones. Therefore, the first chapter of this second part (**Chapter III**) seeks to examine the influence of the structural economic vulnerability of developing countries on their public debt. In the second chapter (**Chapter IV**) of the second part of this thesis, we focus on a specific group of countries: the CFA Franc Zone countries.

Structural vulnerability and excessive public indebtedness in CFA Franc Zone countries: The CFA Franc Zone is composed of countries that are particularly exposed to external and

internal shocks (see, e.g., Guillaumont, 2009, 2011). The choice of this group of countries to complete the study in Chapter IV is due to its own nature: the CFA Franc Zone, created in 1945 during the Bretton Wood agreement, currently comprises two separate monetary areas: the WAEMU (West African Economic and Monetary Union) and the Economic Community of Central African States (ECCAS). Many theoretical and empirical studies (mainly on the European Union) have been conducted on the fiscal discipline and fiscal restructuring in a monetary area (see, e.g., Bayar, 2001, 2009; Huges-Hallet & Lewis, 2004, 2005; Castro, 2007; Tiryaki, 2008, which focus on excessive deficits in the euro area). However, to our knowledge, such topics have been scarcely explored in the context of African monetary unions, such as the CFA[1] Franc Zone. This study focuses on one of the fiscal rules of this monetary area (specifically related to public debt) to investigate the impact of structural economic vulnerability on the probability of excessive debt of these countries.

In a nutshell, this thesis comprises two main parts, each of them encompassing two chapters:

- In the first part, we examine in **Chapter I** the effects of *'large' fiscal episodes in OECD countries on their aid supply* and in **Chapter II**, *the impact of ODA unpredictability and migrants' remittances on fiscal adjustment in developing countries*.
- In the second part, we explore in **Chapter III** the consequences of structural economic vulnerability in developing countries for their public debt and in **Chapter IV,** we focus on *CFA Franc Zone countries to assess whether or not their structural economic vulnerability influences their probability of engaging in excessive debt*.

[1] CFA was defined as 'Communauté Française d'Afrique', but is now known as 'Communauté Financière d'Afrique' for the WAEMU area and 'Coopération Financière en Afrique Centrale' for the ECCAS area.

INTRODUCTION GENERALE

La question du financement du développement demeure une préoccupation majeure pour les pays en développement (PED) et plus particulièrement pour les plus pauvres d'entre eux – les pays les moins avancés (PMA) -. Ces pays disposent de nombreuses sources de financement de leur développement dont notamment : l'endettement à taux concessionnel (Aide Publique au Développement – APD-) incluant l'endettement de l'Etat autant auprès des institutions multilatérales et l'endettement a des Etats développés; l'endettement auprès des Banques Privées sur le marché financier international ; les transferts des migrants ;….etc. L'exposition de ces pays et plus particulièrement des PMA aux chocs internes et externes accroît sensiblement leurs besoins de financement. La problématique du financement du développement est au cœur de cette thèse : nous explorons dans un premier temps comment la politique budgétaire dans les pays de l'OCDE (Organisation pour la Coopération et le Développement Economique) ainsi que celle des PED sont liées aux sources de financement que sont l'APD et le transfert des migrants. Nous nous intéressons ensuite à la façon dont la vulnérabilité de ces pays (PED) affecte leur endettement public.

Dans une **première partie**, nous examinons au **Chapitre I** *les effets des « larges » politiques d'austérité budgétaire des pays donateurs (pays développés de l'OCDE) sur leur offre d'APD* et au **Chapitre II**, *l'impact de l'imprévisibilité de l'APD et des transferts des migrants sur les politiques de consolidation budgétaire des PED.*

En effet, les tensions sur les finances publiques des pays développés (PD) que la crise financière de 2008 et la crise subséquente de la dette des pays européens ont contribué à accentuer, ont remis au goût du jour la question du financement du développement, notamment par la voie de l'APD. A cet égard, cette thèse s'interroge sur l'impact des mesures d'austérité budgétaire dans les principaux pays donateurs de l'OCDE sur leur offre d'aide publique au développement.

De même, les transferts des migrants définis selon Ratha (2003) comme étant les "transferts personnels, sans contrepartie et non marchands entre ménages, s'effectuant d'un pays à un autre" sont comme nous le soulignions plus haut, également une source importante de financement pour les PED. Comment ces transferts en sus de l'APD affectent-ils les mesures d'austérité budgétaire dans les PED ? Cette question est également étudiée ici.

Par ailleurs, la littérature économique a largement établi que l'une des caractéristiques majeure des pays en développement et plus particulièrement des plus pauvres, c'est leur

vulnérabilité économique structurelle. Guillaumont (2009) et Guillaumont et Cariolle (2011) définissent cette dernière comme étant le risque pour un pays (pauvre) de voir son développement obéré par les chocs naturels et externes auxquels il fait face ». Cet indicateur est par ailleurs l'un des critères majeurs d'inclusion et de graduation des pays dans la liste des PMA par les Nations Unies. Plusieurs études ont d'ailleurs montré la nécessité de considérer cet indicateur dans l'examen des critères d'allocation de l'APD (voir par exemple, Guillaumont, 2008; Guillaumont et al., 2013; Guillaumont, 2013). Cependant, cette littérature ne s'est pas intéressée à l'impact de cette vulnérabilité sur l'endettement public des PED. Dans cette thèse, nous essayons de combler ce vide en examinant l'impact de la vulnérabilité économique structurelle sur la dette publique des PED. Nous nous intéressons par la suite au cas spécifique de la Zone Franc CFA en explorant l'effet de cette vulnérabilité sur la probabilité de ces pays de s'engager dans un endettement excessif.

Episodes Budgétaires et Aide Publique au Développement : la plupart des pays développés donateurs d'APD se sont engagés dans des politiques d'austérité "sévères" suite à la détérioration de leurs finances publiques, aggravée par récession induite par la crise financière de 2008 ainsi qu'en raison des conséquences à moyen et long terme du vieillissement de leur population. La littérature économique sur les choix de politique budgétaire ainsi que de leurs conséquences économiques est importante : on peut citer par exemple, Alesina et Perotti (1995, 1997a), Alesina, Perotti et Tavarez (1998), McDermott et Wescott (1996), IMF (1996), OECD (1997), Perotti (1997), Alesina et Ardagna (1998), Heylen et Everaert (2000), Ardagna (2007), Alesina et Ardagna (2010) et IMF (2010)). Tous ces auteurs à l'exception de Heylen et Everaert (2000) aboutissent à la conclusion que « les épisodes d'ajustement budgétaires « sévères » qui consistent principalement en des réductions des dépenses publiques (baisse des transferts et des salaires des fonctionnaires) ont une plus grande chance de conduire à une baisse de la dette publique et d'être expansionnistes. De même, Alesina et Ardagna (2010) montrent que les épisodes d'expansion budgétaire consistent souvent en des hausses de dépenses publiques et que, les baisses d'impôt en période d'expansion budgétaire seraient plus efficaces en termes de stimulation de la croissance économique que les hausses de dépenses publiques. Heylen et Everaert (2000) ont empiriquement contesté les résultats relatifs à la consolidation budgétaire, arguant que les réductions des dépenses publiques ne sont pas la meilleure politique pour assurer un succès de la politique de consolidation budgétaire.

Si la littérature économique s'est intéressée aux conséquences économiques des épisodes budgétaires (consolidation budgétaire et expansion budgétaire) des pays de l'OCDE, elle n'a en revanche pas exploré leurs conséquences sur l'Aide Publique au Développement, même si quelques études ont examiné l'impact des politiques budgétaires sur l'offre d'APD de ces pays donateurs. Ces peu nombreuses études n'ont justement pas pu aboutir à des résultats convergents en ce qui concerne l'impact des politiques budgétaires des pays de l'OCDE sur l'APD : par exemple, Faini (2006) montre qu'une hausse du déficit budgétaire et de la dette publique dans les économies des donateurs réduisent l'APD alors que Round et Odedokun (2004) et Boschini et Olofsgard (2007) n'ont pas pu trouver une relation significative entre les déficits budgétaires et l'offre d'aide.

L'objectif de ce chapitre est d'explorer empiriquement le comportement des donateurs des pays développés en termes d'offre d'APD durant les épisodes budgétaires. En d'autres termes, nous investiguons les effets des épisodes de consolidation budgétaire et de stimulation budgétaire sur l'offre d'APD des donateurs de l'OCDE, indépendamment des effets des autres variables macroéconomiques, des variables politiques, institutionnelles et d'économie politique internationale.

Imprévisibilité de l'APD, Transferts des migrants et Ajustement budgétaire dans les PED :

La problématique des conséquences des épisodes budgétaires et plus particulièrement celle des politiques d'austérité budgétaire sur les économies des PED ont fait l'objet de la littérature économique. Cette dernière comprend deux grandes parties : d'un côté l'impact des mesures de consolidation budgétaire sur la croissance économique, l'investissement, l'épargne….etc (qui couvrent les pays développés comme les pays en développement), et de l'autre, les déterminants de ces épisodes de consolidation budgétaire (qui ont concerné plus les pays développés et où très peu d'études ont été réalisées sur les PED – par exemple Larvigne, 2010). Dans ce chapitre, nous investiguons l'impact des transferts des migrants et de l'imprévisibilité dans les flux d'APD sur les mesures d'ajustement budgétaire dans les PED.

Les transferts des migrants sont considérés aujourd'hui comme une source du financement externe du développement des PED plus importante que l'APD et les Investissement Direct Etrangers (voir par exemple, Ratha 2009, IMF 2005, World Bank, 2006 et Chami et al., (2008)). En outre, ces transferts de migrants sont reconnus comme étant une source stable de financement du développement (Ratha, 2005) alors que l'APD a été jugée comme étant

imprévisible (Voir Vargas Hill (2005), et Celasun et Walliser (2008)), en référence au concept de « prévisibilité de l'APD » adopté dans le cadre de la déclaration de Paris sur l'efficacité de l'APD.

Des chercheurs comme Chami, Cosimano and Gapen (2006) montrent que les transferts des migrants, en augmentant la consommation, élargissent la base fiscale et ainsi, permettent au gouvernement d'accroître leur dette ou leurs dépenses publiques. D'autres auteurs comme Gemmell et McGillivray (1998) ont aussi mis en évidence que l'imprévisibilité de l'APD conduit à une baisse des dépenses publiques et/ou une hausse des impôts. A cet égard, l'on pourrait se demander si « *les transferts des migrants et l'imprévisibilité de l'APD conditionnent les choix des mesures d'austérité budgétaire dans les PED* ».

La **deuxième partie de la thèse** s'intéresse aux *conséquences de la vulnérabilité économique structurelle des PED sur leur endettement public.* A cet égard, le **Chapitre III** explore l'impact de la vulnérabilité structurelle des PED sur leur dette publique et le **Chapitre IV** se concentre sur le cas spécifique *des pays de la Zone CFA*[2] *pour évaluer si leur vulnérabilité économique structurelle n'influe pas sur leur capacité d'endettement excessif.*

Vulnérabilité structurelle et endettement public des PED : la vulnérabilité économique structurelle des PED est-elle un déterminant majeur de leur endettement public ? Les PED sont en général soumis à plusieurs types de chocs comme par exemple, les chocs des prix des matières premières, les désastres naturels, les conflits, les chocs inhérents aux marchés financiers mondiaux, les chocs sur les taux d'intérêt ou les taux de change, les fluctuations de l'APD, les chocs liés aux politiques de migration des pays hôtes…etc. La classification de la Banque Mondiale distingue plusieurs catégories de pays au sein du groupe des PED: les Pays à Faible Revenu (PFR) ; les Pays à Revenu Intermédiaire (PRI) (catégorie au sein de laquelle on peut distinguer les pays de la tranche supérieure (PRIS) et de ceux de la tranche inférieure (PRII)), et les Pays à Revenu Elevé (PRE). Ces derniers sont exposés aux chocs naturels ou aux chocs provenant directement de la dynamique des marchés mondiaux, alors qu'au sein des PED, on note que les PRIS ont un accès relativement important au financement par le marché alors que les PFR et les PRII y ont un faible accès. Ces derniers ont d'ailleurs

[2] Le sigle CFA initialement défini comme 'Communauté Française d'Afrique', est actuellement considéré comme 'Franc de la Communauté Financière d'Afrique' pour l'Union Economique et Monétaire de l'Afrique de l'Ouest (UEMOA) et 'Coopération Financière en Afrique Centrale' la Communauté Economique des Etats de l'Afrique Centrale.

bénéficié d'un allègement substantiel de leur dette à travers les initiatives PPTE (Pays Pauvres Très Endettés) et Allègement de la Dette Multilatérales (IADM). Cependant, en dépit de ces initiatives, leur problème d'endettement persiste (voir par exemple, Christensen (2005); Rocher (2007) et Cabrillac et Rocher (2009) pour le cas de l'Afrique Sub-saharienne). En appui à cette thèse, Guillaumont (2006) ainsi que le PNUD[3] (2010) par exemple montrent que la vulnérabilité croissante à l'endettement public trouve son origine dans les faiblesses structurelles des PED et particulièrement des plus pauvres d'entre eux. C'est dans cette optique que s'inscrit le premier chapitre de cette deuxième partie (**Chapitre III**) qui cherche à examiner l'influence de la vulnérabilité économique structurelle des PED sur leur endettement public. Dans le deuxième Chapitre de cette deuxième partie (**Chapitre IV**), nous focalisons sur un groupe spécifique de pays : la Zone Franc CFA.

Vulnérabilité structurelle et Endettement excessif dans les pays de la Zone Franc CFA : la Zone Franc CFA est composée de pays particulièrement exposés aux chocs internes et externes (voir Guillaumont, 2009, 2011). Le choix de cette zone pour compléter notre étude précédente est imputable à sa nature même : la Zone CFA, créée en 1945 durant les accords de Bretton Woods comprend deux zones monétaires distinctes - l'Union Economique et Monétaire Ouest Africaine (UEMOA) et la Communauté des Economique des Etats de l'Afrique Centrale (CEEAC)-. De nombreux travaux théoriques et empiriques portant sur les pays développés (notamment l'Union Européenne) ont été réalisés sur la problématique de la discipline et la restructuration budgétaires dans une zone monétaire. On peut par exemple citer les études relatives aux déterminants des déficits excessifs dans la zone euro (voir par e.g. Castro, 2007; Tiryaki, 2008; Bayar, 2001, 2009; Huges-Hallet and Lewis, 2004, 2005). Cependant, à notre connaissance de telles études portent rarement sur les PED, notamment dans le contexte africain, pour des unions monétaires comme la zone CFA. Ainsi, dans notre étude ici, nous nous appuyons sur l'une des règles budgétaire adoptée par les pays de cette zone (en l'occurrence celle liée à la dette publique) pour investiguer l'impact de la vulnérabilité économique structurelle sur la probabilité d'endettement excessif des pays de la zone.

En résumé, cette thèse comprend deux grandes parties comportant chacune deux chapitres :

[3] Programme des Nations Unies pour le Développement.

- Dans la **première partie**, nous examinons en **Chapitre I** *les effets des « larges » épisodes budgétaires des pays donateurs (pays développés de l'OCDE) sur leur offre d'APD* et en **Chapitre II**, *l'impact de l'imprévisibilité de l'APD et des transferts des migrants sur les politiques de consolidation budgétaire des PED.*

Dans la **deuxième partie**, nous explorons *les conséquences de la vulnérabilité économique structurelle des PED sur leur endettement public* dans le **Chapitre III**. Cette étude se concentre dans le **Chapitre IV** sur le cas spécifique des pays de la Zone CFA pour évaluer si *leur vulnérabilité économique structurelle n'influe pas sur leur capacité d'endettement excessif*.

PART I: FISCAL EPISODES, OFFICIAL DEVELOPMENT AID AND MIGRANT REMITTANCES

CHAPTER I[4]: The consequences of fiscal episodes in OECD countries for aid supplies.

Abstract

This chapter contributes to the established literature both on the side of fiscal episodes (for e.g. Alesina and Perotti 1995; Alesina et al. 2010) and that of aid supplies (for e.g. Mosley 1985; Faini, 2006) by investigating the effects of fiscal episodes in OECD donor countries on their aid effort vis-à-vis developing countries. We use descriptive statistics provided by Alesina and Ardagna (2010) on episodes of fiscal consolidation and stimuli in OECD countries and regression models to perform this analysis. The study is performed on a sample of 19 OECD DAC countries as well as on sub-samples and over the period 1970-2007. Overall, the results suggest that OECD Donor countries curtail their aid effort during their large episodes of fiscal consolidation whereas the effects of large fiscal stimuli episodes depend on the aid variable considered. However, the European Union and the Non-European countries behave differently in terms of their aid supply.

JEL Classification Numbers: F35, E62, H62, H85

Keywords: development aid, fiscal consolidation, fiscal stimuli

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1. Introduction

In response to the largest post-war recession, OECD governments have run up record peacetime budget deficits. The recent financial crisis has constrained them to embark on major fiscal stimulus in order to rescue their financial institutions and to mitigate the ensuing recession. As a result, budget deficits and government debt soared, leading to a substantial deterioration of their fiscal situations.

Actions to design and implement "exits" from fiscal stimulus become imperative and prompt countries to adopt fiscal consolidation measures in order to make their public finances sustainable. Furthermore, population ageing creates pressures on public finances for the medium to long-run, thereby adding to the fiscal consolidation effort.

While there is an ongoing debate about the best balance between cuts in expenditure and rises in tax during episodes of fiscal consolidation, several empirical studies (Alesina and Perotti (1995, 1997a), Alesina, Perotti & Tavarez (1998), McDermott and Wescott (1996), IMF (1996), OECD (1997), Perotti (1997), Alesina and Ardagna (1998), Ardagna (2007), Alesina and Ardagna (2010) and IMF (2010)) tend to convey the same message: "fiscal adjustments, which rely primarily on spending cuts, that is, cuts on transfers and on the government wage bill have a better chance of being successful and are expansionary". Alesina and Ardagna (2010) have also shown evidence that fiscal adjustments which rely primarily on tax increases and cuts in public investment tend not to last and are contractionary.

However, Heylen and Everaert (2000) empirically contest the result according to which current expenditures reductions are the best policy to achieve a successful fiscal consolidation.

Broadbent and Daly (2010) review every major fiscal correction in the OECD since 1975 and find that decisive budgetary adjustments that have focused on reducing government expenditure have been successful in correcting fiscal imbalances and typically boosted growth. They also highlight that tax-driven fiscal adjustments, by contrast, fail to correct fiscal imbalances and are damaging for growth. However, the authors mention that decisive expenditure-driven fiscal adjustments are politically difficult to implement and tend to take place only following a change in government and/or once bond markets force the government hand.

Furthermore, Alesina and Perotti (1995a) find evidence that fiscal expansions typically occur through increases in expenditures. More recently, Alesina and Ardagna (2010) also find

evidence that fiscal stimuli based on tax cuts are more likely to increase growth than those based upon spending increases.

In view of all these different empirical results, one can question whether fiscal episodes in donors' governments do not affect aid supply. Indeed, it is likely that during fiscal consolidation episodes when government expenditures are curtailed, development aid supplied by the OECD DAC countries - which is a category of government expenditures - will also be reduced. Similarly, we can also expect donors' governments to increase aid expenditures during fiscal stimuli years as the other categories of government spending rise. At the same time, the OECD DAC countries have committed either individually or collectively (through international meetings such as the Gleneagles summit) to achieve a target level (the international ODA target of 0.7% of Gross National Income) of aid flows granted to developing countries. In 2010, the OECD has estimated that at least USD 10-15 billion must still be added to the forward spending plans if donors, are to meet their 2010's commitments. Moreover, due to the adjustment measures adopted by the OECD country members in response to the recent financial and economic crisis, Africa will not likely receive more than the USD 11 billion over the USD 25 billion promised at the Gleneagles summit. Recent figures[5] regarding the net official development assistance (ODA) disbursements confirm its announced decline by the OECD: the overall net ODA of OECD DAC members (in per cent of their gross national income –GNI-) dropped in real terms by 2.7% from 2010 to 2011, reflecting fiscal constraints in several DAC countries which have affected their ODA budgets. In addition, bilateral aid to sub-Saharan Africa also experienced a fall of -0.9% in real terms compared to 2010. Nevertheless, aid to the African continent increased by +0.9% as donors provided more aid to North Africa following the revolutions in the region. The net bilateral ODA flows disbursed towards the group of Least Developed Countries (LDCs) also declined severely by 8.9% in 2011 compared to 2010.

The figures[6] reported in Table 1 provide evidence that over the period 1970-2007, on average, only four countries (Netherlands, Norway, Sweden and Denmark) have achieved or even exceeded the international ODA target of 0.7% of GNI.

[5] See in the OECD Website:
http://www.oecd.org/newsroom/developmentaidtodevelopingcountriesfallsbecauseofglobalrecession.htm

[6] Figures are computed by the Author using the OECD Statistics on Official Development Assistance (ODA) and Gross National Income (GNI).

Table 1: Average Aid Supplies during the period 1970-2007 by OECD DAC Countries

Country	Average ODAGross to GNI Ratio over 1970-2007	Average ODANet to GNI Ratio over 1970-2007	Average NAT to GNI Ratio over 1970-2007
Australia	0.37	0.32	0.32
Austria	0.26	0.22	0.19
Belgium	0.46	0.45	0.43
Canada	0.40	0.37	0.36
Denmark	0.80	0.75	0.73
Finland	0.34	0.32	0.31
France	0.60	0.52	0.43
Germany	0.39	0.33	0.31
Ireland	0.23	0.17	0.19
Italy	0.22	0.19	0.18
Japan	0.31	0.26	0.25
Netherlands	0.82	0.79	0.76
New Zealand	0.26	0.25	0.25
Norway	0.81	0.78	0.78
Portugal	0.19	0.13	0.16
Spain	0.20	0.14	0.17
Sweden	0.76	0.75	0.73
United Kingdom	0.37	0.35	0.33
United States	0.21	0.19	0.18

Why do OECD DAC not fulfill their commitments in terms of aid supply? These results suggest that several variables affect the decisions of donors to supply aid and may explain why many of them do not fulfill their ODA commitments. In this chapter, we explore the role of fiscal episodes in explaining this phenomenon.

As we will see later, the empirical literature has already established that recipient-country characteristics such as income level, population, and political system, and the United Nations voting patterns (see for e.g. Alesina and Dollar 2000; Dollar and Levin 2006) affect aid inflows. However, the empirical literature on the donor-side's determinants of aid, especially the one that focuses on the fiscal variables remains short and inconclusive. For example, Faini (2006) finds evidence that higher budget deficit and higher stock of public debt reduce aid, whereas Round and Odedokun (2004) and Boschini and Olofsgard (2007) find no significant relationship between deficits and aid provision. Moreover, none of these studies explore the effects that fiscal episodes in donor countries may have on aid provision.

In this chapter, we investigate how donors behave in terms of supplying aid during fiscal episodes. In other words, we explore the long-run average (LRA) effects of fiscal consolidation and stimuli episodes on OECD donor countries' aid supplies, irrespective of

their effect on per capita income, and other economic, political, institutional and international political economy variables. We follow the literature on fiscal episodes and use descriptive statistics as well as regression models to perform this analysis.

The chapter is structured as follows: in the next section (II), we provide a literature survey on the topic. We then explain how the fiscal episodes in OECD countries are determined (III). In section IV, we present our model specification and discuss the expected sign of the explanatory variables. Section V discusses the data and econometric methodology and section VI presents empirical results. The last section (VII) concludes.

2. Literature Review

Several, though controversial studies have been conducted on the supply of foreign aid, with most of them relying on how recipients' characteristics affect aid delivery. These studies examine the potential factors and motivations behind the supply of aid by answering questions such as: Who received aid? How much aid is received and for what kinds of activities? Many studies find evidence that the donors' political, economic and strategic interests appear to dominate altruistic and development-centered motivations in their foreign aid programs. For example, Alesina and Dollar (2000) use bilateral data on DAC countries over 1970-1994 and find evidence that factors such as colonial ties and strategic considerations (i.e. proxied by the degree of correlation in the donor and recipient countries' voting records at the UN) are among the factors that could influence the flow of bilateral aid.

However, limited studies have dealt with the supply side determinants of aid flows from the donor's perspective (that is, the determinants of "aid effort" or "aid generosity"). In particular, studies assessing how macroeconomic variables (especially fiscal policy ones) can affect theoretically and empirically aid generosity remain scarce: Beenstock (1980); Mosley (1985); Faini (2006) and recently Jones (2011) have been the few authors that explore both theoretically and empirically the determinants of aid supplies. We present here the theoretical and empirical literature on this issue.

2.1 The theoretical literature review on the determinants of aid flows

Beenstock (1980) developed a statistical model that sheds light on the political decision-making process regarding the allocation of aid. He starts by arguing that in allocating a given level of aid, governments face major constraints that are: the GNP (the Gross National Product), the population size (POP), the balance-of-payments (BAL) (as a possible constraint on affordability), the unemployment rate (U) and the net budget of the Central Government (BUGD). Thus, he hypothesizes the objective function of a donor government as:

G = G [ODA (+), BAL (+), POL (-) ...] **(1)** where partial derivatives are indicated in parenthesis for the respective variables. ODA is the amount of Aid and POL is a measure of political rancour that ODA might generate. According to the author, this latter index can vary directly with unemployment, the net budget surplus (BUDG) as well as with balance-of-payments pressures (and so, inversely with BAL) since ODA represents a balance-of-payments debit. However, the richer the population, the easier it will be for governments to grant aid. Henceforth, Beenstock (1980) characterizes the political constraint as:

POL = POL[U(+), BUDG(+), BAL(-), GNP(-), POP(+), ODA(+)] **(2)**

Thus, for given values of U, BUDG,...etc, the political costs to donor governments in providing aid will depend upon the quantity of ODA that they provide. Expressed in other words, according to equation (2), for given quantities of ODA, the greater the unemployment and the budget surplus are, the higher political rancour will be and, the stronger the balance-of-payments and the GNP are, the lower is political rancour.

As the balance-of-payments will be adversely affected by ODA itself, a further constraint will be: BAL = B[ODA(-),.....] **(3)**

The optimal ODA allocated by the donor government may be determined by maximizing G in equation (1) using equations (2) and (3) as constraints. The solutions function for ODA will, therefore take the general form:

ODA* = F[U(-), BUDG(-), BAL(+), GNP(+), POP(-),.....] **(4)**

From this equation, it can be stated that during times of higher unemployment or of tighter budget, the political cost of ODA reduces the ODA allocation. The positive relationship between ODA* and the balance-of-payments reflects two considerations:

-First, the stronger the balance-of-payments, the lower will be the political cost to provide aid.

-Second, assuming G (...) is convex, the more their balance-of-payments objectives are attained, the higher the priority the authorities are likely to attach to competing objectives including ODA.

Beenstock (1980) estimates empirically the model of equation (4) by the use of multiple-regression techniques on a sample of alternatively 8 (Canada, France, Germany, Japan, UK, US, the Netherlands and Sweden) and 6 countries (Canada, France, Germany, Japan, UK, US) over the period 1960-1976 (T=17 years). Since the total number of observations is limited, the author estimates several versions of the model (4) by adding alternatively the previous regressors and country dummies.

Overall, he finds evidence that aid effort is negatively and significantly affected by the unemployment level, the population level, and the net budget surplus, whereas it is positively affected by the balance-of-payments, the GNP, and a time trend.

Mosley (1985) also develops a theoretical model on aid flows determinants relying on Breton (1974)'s approach to market adjustment in the case of goods provided by the public sector. He treats aid as a public good for which there is a market, albeit a highly imperfect one. Citizens have demand curves for public sector output such as policy or foreign aid just as they have for private sector outputs like oranges in the sense that they know how much they would like to "buy" at a given price – called "tax price" – or that part of their total tax payments which is allocable to that public good. However, they cannot adapt their actual consumption to their desired consumption of such public goods by means of market behaviour. Hence, if they wish to achieve such adaptation of actual output to the desired level, they must try to do so through political action: forming or joining pressure groups, writing to politicians or newspapers..etc.... This action, if successful, will bodily shift the (vertical) supply curve for the public good in question.

According to the author, aid determinants rest on a demand and a supply function of aid. The demand function depends on the donor countries' income relative to others countries (the poorer the country is relative to the others, the lower the share of aid burden it should bear), the quality of the product, (whose dimensions include the proportion of aid going to the poorest countries – i.e. the proportion of aid used for purposes such as rural development and famine relief, the amount of aid available on grant terms....and so on). Formally, the model is stated as: $A_{it}^{*} = b_0 + b_1(-\frac{Y_i}{Y_w})_t + b_2\theta_{it}$; $b_1 > 0$; $b_2 > 0$ **(5)** where A_{it}^{*} is the desired quantity of aid

by country i in year t; $(\frac{Y_i}{Y_w})_t$ is the level of per capita income in country i in relation to per capita of other OECD countries in year t; and θ_{it} is an indicator of aid quality in country i and year t.

Mosley relies on Wildavsky (1964)'s assertion that the principal influence on the budget for any spending agency in the current year is the last year's budget and assumes that this is even more true for aid compare to other categories of public expenditures. Since much aid consists of money committed several years in advance for the support of particular projects, such aid cannot be rescinded without serious offense to foreign governments.

Summing up, he postulates that the supply of foreign aid expenditures by a government in any year is heavily influenced by a constant representing last year's expenditure and that any increase or decrease in the value of this constant will be determined by:

- the behavior of the Finance Ministry which reflects the state of the domestic economy;

- the aid-giving behavior of the international community; and

- an adjustment parameter reflecting the adjustment of supply, thus determining the electoral demand for aid.

Formally, $A_{it} = b_3 A_{it-1} + b_4 U_{it} + b_5 B_{it} + b_6 (\sum_{i+1}^{n} A_t) + b_7 (A^*_{it-1} - A_{it})$ **(6)**

where A_{it} = the actual aid disbursement by government of country i in year t.

A^*_{it-1} = the « desired » quantity of aid in country i in year t;

U_{it} = the unemployment in country i in year t.

B_{it} = Government Budget deficit in country i in year t;

$\sum_{i+1}^{n} A_t$ = Aid disbursement in period t of all OECD countries other than country i.

The adjustment of the supply function of aid to the demand function of aid (obtained by substituting **(5)** into **(6)**) and simplifying gives the following expression:

$$A_{it} = c + b_4 U_{it} + b_5 B_{it} + b_6 (\sum_{i+1}^{n} A_t) + b_{10} A_{it-1} + b_8 (\frac{Y_i}{Y_w})_{t-1} + b_9 \theta_{it-1} \quad \textbf{(7)}$$

where the constant c = $b_0 b_7$; $b_8 = b_7 b_1$; $b_9 = b_7 b_2$; $b_{10} = b_3 - b_7$.

This equation is estimated for each country separately as well as on pooled regression since the author focuses on the differences between response patterns in donor countries as well as

on the common factors of the "political economy of aid". The sample covers 9 OECD countries (Canada, France, West Germany, Japan, Netherlands, Norway, Sweden, USA and U.K) over the period 1961-1979. Using OLS technique country by country, he observed a positive and significant effect of the central government budget deficit on aid flows for the Netherlands and the United Kingdom, whereas the effect is mixed (either positive or negative) but not statistically significant for the other countries. The unemployment rate exerts a negative effect on aid disbursements only for the United Kingdom and path dependence of aid disbursements is observed for Canada, France, West Germany, the Netherlands, Norway, Sweden and the U.K. In the meantime, respectively positive and negative effects of the level of per capita income (in relation to per capita income of other OECD countries in year t) on aid disbursements are obtained for the Netherlands and the U.S.A with no effect arising for this variable for the other countries. Peer-effects exert a positive influence on foreign aid for France, West Germany, Japan, the Netherlands, the U.S.A and the U.K. The pooling of the data for the nine countries over the period 1961-1979 leads the author to conclude for the existence of positive effects of peer-effects and past commitments on aid disbursements.

Now, what about Faini (2006)'s model? He explores the relationship between fiscal policy and aid effort of donor countries. He starts by making the assumption that the Official Development Assistance (ODA) is a discretionary item of the budget and is to some extent subject to the vagaries of the budget process. According to him, to the extent that the government must choose among competing allocations of limited resources, there are good reasons to believe that, faced with budgetary difficulties, policymakers will first cut discretionary spending, with the least priority item taking the biggest toll. He develops a simple model where the government faces a standard budget constraint at time t:

$B_{t+1} = (1+r)B_t - PS_t + A_t$ **(8)** where B_t is the stock of public debt at time t; r is the interest rate; PS_t is the Primary Surplus (excluding A_t) and A_t is a discretionary spending item (say, foreign aid).

He assumes that policymakers seek to minimize the gap between A_t and its target level A^* and that they also dislike higher future public debt B_{t+1} to the extent that it may constrain their future choice or put an undue burden on future generations. After formally maximizing the objective function of the policymaker subject to the budget constraint, he obtains the following function:

$$A_t = \frac{1}{1+\alpha}(PS_t - (1+r)B_t) + \frac{\alpha}{1+\alpha}A^* \quad \textbf{(9)}$$

where α, is the weight of A in the policymaker's utility function.

From this model, it can be stated that a strong fiscal position will be associated with higher discretionary spending, including on Official Development Assistance (ODA). Moreover, a larger value of α, i.e. a larger weight of A in the policymaker's utility function, should be associated with a greater rigidity of A and as a result, a more limited responsiveness to changes in budgetary conditions.

In addition, since the level of foreign aid is a function of its desired level A^*, the choice by the policymaker may be a function of both income per capita in the donor country and the government's political orientation. Therefore, he estimates the following empirical model:

$$\begin{aligned} {A_t}/{GDP_t} &= \alpha + \alpha_1 PO_t + \alpha_2 Y_t + (\beta_1 + \beta_{12} PO_t)({D_t}/{GDP_t}) + (\beta_2 + \beta_{22} PO_t)({B_t}/{GDP_t}) \\ &+ \beta_3({(Y - Y^*)}/{Y^*}) + \beta_4({A_{t-1}}/{GDP_{t-1}}) \end{aligned} \quad \textbf{(10)}$$

where PO_t is the political orientation of the government at time t; Y_t is the output and ${(Y - Y^*)}/{Y^*}$ denotes the output gap. He estimates this model where the dependent variable is proxied alternatively by the net official ODA; the total official flows and Roodman's Net Aid transfers measure. The sample covers 15 donor countries over the period 1980-2004. Using fixed-effects estimation, he finds that aid effort is positively associated with the cyclical position of the donor economy and negatively affected by the debt stock. However, the significance of the cyclical position of the donor's economy disappears when using total official flows as proxy for aid generosity. The donor's fiscal surplus exhibits a positive effect on aid flows when controlling for the government's political orientation but has no statistically significant effect when using total official flows as proxy for aid generosity. Overall, he finds evidence that an increase in the budget deficit or in the stock of debt leads to a severe decline of the development assistance.

The last theoretical model is that of Jones (2011). His objective is to examine the aid expenditures' response to banking crises in donor countries. He assumes that over the long-run, donors seek to achieve a target ratio of total aid to domestic income, which largely depends on various long-run or fixed factors. These factors can vary over time through the influence of fiscal policy factors such as government spending trends or long-run fiscal balances as well as a time trend. The aid granting decision of policymakers to achieve this

target ratio can be affected in the short-run by unexpected macroeconomic shocks and a random error term for which we do not know a priori the form. However, when a deviation from the aid targets occurs temporarily at time t-1, we expect adjustment towards the target in time t, with a high probability of this adjustment to be incomplete and potentially subjected to new shocks.

Jones (2011) clarifies the heterogeneity and time-varying nature of long-run targets by considering a general form of the aid target ratio which is represented by the function $\widehat{\theta}_i(x_t,t)$ where t denotes a unit-specific trend, and x_t a vector of time-varying factors where both determine the long-run aid target ratio sets by each donor country. A simple model for the actual net aid to income ratio for country i at time t can be written as:

$$\frac{\tilde{a}_{i,t}}{\tilde{y}_{i,t}} = \frac{\tilde{a}_{i,t-1}}{\tilde{y}_{i,t-1}} \left(\frac{\tilde{\theta}_i(x_t,t)}{\tilde{a}_{i,t-1}/\tilde{y}_{i,t-1}}\right)^{\alpha_i} \tilde{\varepsilon}_{i,t} \quad \textbf{(11)}$$

where it is assumed that $\alpha_i \geq 0$, and $\tilde{\varepsilon}_{i,t}$ represents an error term for country i over time t.

The transformation of this equation leads to the following error correction form:

$$\Delta a_{i,t} = \Delta y_{it} + \alpha \Delta \theta_i(z_t,t) - \alpha[a_{i,t-1} - \{\theta_i(z_{t-1},t-1) + y_{i,t-1}\}] + \varepsilon_{i,t} \quad \textbf{(12)}$$

By assuming that the (log) error term is a linear function of additional variables denoted by the vector x and a random error and, by allowing for a dynamic structure and a unit-specific intercept, he obtains: $\varepsilon_{it} = \mu_i + \sum_{j=0}^{J} x'_{i,t-j}\lambda_j + \eta_{it}$. Re-specifying equation **(12)** to incorporate these extensions, yields a more general error correction model:

$$\Delta a_{i,t} = \mu_i + \gamma \Delta y_{it} + \alpha \Delta \theta_i(z_t,t) - \alpha[a_{i,t-1} - \{\theta_i(z_{t-1},t-1) + \phi y_{i,t-1}\}] + \mu_i + \sum_{j=0}^{J} x'_{i,t-j}\lambda_j + \eta_{it} \quad \textbf{(13)}$$

He uses equation **(13)** to derive long-run trends and short-run dynamics determinants of total bilateral aid (net bilateral aid disbursement minus debt relief, which excludes disbursements to multilateral organizations but includes support to NGOs and international private organizations) over the period 1960-2009. Specifically, he employs the two-step method of Engle and Granger with fixed effects. Results show that bilateral aid supplies are positively driven in the long-run by government saving and government expenditures (both in percent of GDP). In the short-run, the banking crisis exerts negative effects on aid supplies when controlling for its possible indirect effects. In addition to the negative effects of the lagged peer-effects, the real GDP per capita of the donor's countries, the trade (Export + Imports)

share of GDP and the government spending as a percentage of GDP drive positively aid disbursements on the short-run.

2.2 The review of the empirical literature on the determinants of aid generosity

Besides the theoretical models described above, several other empirical studies have been conducted on this topic.

Round and Odedokun (2004) investigating the decline in aid flows over the period 1970-2000 for a sample of all 22 DAC countries, assessed the determinants of gross disbursements of ODA loans and grants, as a proxy of aid generosity. By making a distinction between political and non-political factors, they find evidence that aid generosity is driven positively by per capita income, peer pressure, the number of checks and balances, polarization and fractionalization within the government and negatively by the growth of the donor's population. Whereas mixed results are obtained for the time trend (there is no clear increase in aid budgets overtime), they do not find a significant effect of political orientation and fiscal balance on aid effort.

Bertoli et al. (2008) have concentrated their study on the determinants of aid effort (proxied by the net aid disbursements, net of debt relief, as share of GDP) for all of the 22 OECD DAC countries over the period 1973-2002, with a particular focus on the Italian case for a comparison purpose. They employ fixed effects estimation technique, and observe that the output gap, the extent of government intervention and redistribution (proxied by government receipts on GDP), the trade balance, the political orientation (i.e. conservative government raises aid effort) and the fiscal deficit exerts a positive effect on aid generosity. Growing income inequality and population are found to be negatively associated with aid effort.

Mendoza et al. (2009) investigate in the wake of the global financial crisis whether economic and financial conditions are negatively associated with official development assistance (both bilateral ODA and total ODA) provided by the USA. Focusing on the period 1967-2007, they infer that US ODA could fall from 13 to 30 percent depending on the depth of the economic recession. Among the control variables, they observe that the party affiliation of the US President and tax revenues do not affect significantly both bilateral and total US ODA with the latter appearing to increase during the period of post-Monterrey. However, the real GDP

per capita and the Gini coefficients exhibit inconsistent significance, rendering inference on these variables inconclusive.

The effects of banking crisis on aid flows have been explored by Dang et al. (2010). They use a sample of 24 donor countries over the period 1977-2007 as well as two indicators of aid: Net Aid disbursements and Net Aid Transfers. Using of fixed effects estimation, they find evidence that banking crises exert severe negative effects on aid supplies, with these effects diminishing over time. The lagged budget surplus/deficit (in % of GDP) in the donor's countries adversely influences aid flows, suggesting that the budget surplus is achieved by cutting aid along with many other spending categories. Moreover, donor's per capita income, the unemployment rate and the real exchange rate of the donor's country influence positively the net aid disbursements, whilst inflation rates and inequality (Gini coefficient) affect it negatively. No effect is obtained for the trade share of GDP, the (log) of population as well as political variables such as Corruption index (ICRG, 0-6 scale), Right-wing party, and Left-wing party in the donor countries.

Mold et al. (2010) also explore empirically the determinants of net bilateral ODA in a panel of all 22 DAC countries over the period 1960-2007. By employing the System-GMM estimator (Blundell and Blond, 1998) and fixed effects, they observe that aid disbursements by donors are path dependent. Furthermore, the fiscal balance and military expenditure (both as a percentage of GDP) exert a positive effect on the aid disbursed. Despite the significant negative effect of GDP growth on aid-to-GDP ratio, the authors conclude that economic growth in donor countries did not play a critical role in aid allocation in the past, as this effect is low. Overall, Mold et al. (2010) conclude that the scope for allocations to aid are larger when fiscal circumstances allow it, and that geopolitical and political purposes are important in aid disbursements.

Chong and Gradstein (2002) examine the determinants of foreign aid with respect to the donors. They perform two kinds of analysis: a first one examining individual attitudes towards foreign aid on data covering 10,000 individuals surveyed in 1995-1997 and 1999-2000 in connection with the World Value Survey; and a second one where they develop a political economy model analyzing the determinants of total aid disbursements by considering a sample of all 22 DAC countries over the period 1973-2002. Applying both fixed-effects panel data and Arellano-Bond dynamic estimator techniques, they observe that richer and more egalitarian countries tend to provide more aid; the amount of aid raises when in the donor countries the chief executive's party belong to the left-wing party or when tax revenues

increase. However, aid disbursements are negatively affected by corruption in donor countries.

Other studies have focused more on the political determinants of aid supplies.

Boschini and Olofsgard (2007) test whether the sizeable reduction in aggregate level of aid flows in the 1990's was due to the end of the Cold War. They use a dynamic econometric methodology (both fixed effects and GMM procedure) on a panel of 17 donor countries over the period 1970-1997. Their results indicate that total aid disbursements were positively correlated with the military expenditures of the former Warsaw Pact countries in the 1970's and 1980's, but not in the 1990's. The authors conclude that the end of the Cold War led to cuts in the aid budgets because one important motivation for aid disbursements altogether disappeared. With regard to the control variables, the GDP per capita, aid fatigue, the life expectancy and the size of the population of donors' countries affect positively the aid supplies while the unemployment rate affect them negatively. The variables fiscal balance and the variable capturing the "aid to Central and Eastern European Countries and new independent states from the former Soviet Union" do not exert a significant effect on aid supplies by donors.

Dustin Tingley (2010) has broken down foreign aid by different categories (e.g., low-income versus high-income developing countries) and channels (bilateral versus multilateral) to examine how the domestic political and economic environment influences the support for foreign aid. Using two main political variables (a measure of the government´s ideological orientation and a variable capturing the changes in welfare state institutions proxied by the time-varying "generosity" indicator calculated by Scruggs (2006)), he finds evidence that real GDP growth affects positively only aid to Low Middle Income Countries/Other Middle Income Countries (LMIC/OMIC). Moreover, political/economic openness affects negatively aid to LMIC/OMIC, whilst cold war is positively associated with total aid, multilateral aid and aid to LDC/OLIC (Least Developed Countries/Other Least Income Countries), but not with aid to LMIC/OMIC. A critical finding of the author is that as governments become more conservative, their aid effort is likely to fall. Moreover, changes in welfare state institutions exert positive effects on total and multilateral aid as well as aid to LDC/OLIC, but no significant effect on LMIC/OMIC.

Recently, an extensive analysis of the determinants of aid generosity has been performed by Fuchs et al. (2012). In fact, the latter provide a comprehensive review of the existing literature on donors' aid budgets and examine the variables that determine robustly aid effort (measured

by the Official Development Assistance (ODA) as a share of gross national income) of the 22 OECD DAC members. This study is conducted over the period 1976-2008 and tests several hypotheses concerning international, domestic politics and macroeconomic determinants of aid effort as well as the potential substitute and complements of ODA. The authors observe that, among variables capturing the overall budget constraints and macroeconomic conditions, only the debt burden appears to be negatively and significantly associated with aid generosity of OECD countries.

Overall, we can infer that the empirical literature does not provide a clear-cut stable relationship between aid supplies and its determinants. In particular, the studies that do exist on the fiscal determinants of aid supply contradict one another sufficiently so that there is no trenchant evidence on the relationship between fiscal policy and aid flows.

Our purpose in the following sections is to understand how fiscal variables, especially fiscal episodes, namely fiscal consolidation and fiscal stimuli episodes in donor countries affect the aid disbursements to developing countries. The next section will consider how these episodes fiscal in OECD countries are determined.

3. The determination of Fiscal episodes in OECD Countries

The choice of the approach to measure the fiscal episodes is a critical point when assessing their effects on aid supplies.

The empirical literature provides several definitions for timing fiscal contractions and stimuli (expansions). Tables 2 and 3 provide respectively a summary of the main definitions on fiscal episodes as well as of the main findings on fiscal episodes. Most of the definitions rely on the structural budget balance concept, which is the balance that results from intentional actions of policymakers.

Table 2: Summary on the main Definitions of Fiscal Episodes

Study	Definition of Fiscal Episodes[7]
IMF (1993, 1995)	A period of fiscal adjustment is defined by at least two years period, during which there is a change in the structural budget balance of at least 1,5 percentage points of GDP.
Giavazzi and Pagano (1995)	Fiscal consolidation is a dummy which equals 1 during episodes of protracted and sizable budget cuts, even if not persistent. This dummy tries to capture the points of where the change in the cyclically adjusted primary deficit is abnormally large as a percentage of potential GDP. More precisely, for a given country at time t this dummy equals 1 if the cumulative change in the structural deficit: (i) in 4 successive years including *t* exceeds 5 percent of potential GDP, or (ii) in 3 successive years including *t* exceeds 4 percent of potential GDP, or (iii) in 2 successive years including *t* exceeds 3 percent of potential GDP, or (iv) if the change in the structural deficit in year *t* exceeds 3 percent, and equals 0 otherwise.
Cour et al (1996)	Large scale fiscal adjustment episodes are defined three-year period, during which there is a change in the primary structural budget balance of at least 3 percent of GDP. The Large scale fiscal expansion episodes are defined symmetrically to those of fiscal consolidation.
OECD (1996)	Fiscal consolidation (stimuli) episodes are defined as those where there is a change of at least 3 percent of GDP in the structural budget balance, in consecutive years.
Alesina and Perotti (1995a and 1996)	In any given year, the Blanchard fiscal stance(BFI) is: - Neutral when BFI is (% of GDP) between -0.5 and 0.5; - Loose or a small expansion when BFI is (% of GDP) is between 0.5 and 1.5; - Very loose or a strong expansion when BFI is (% of GDP) larger than 1.5. - Tight or a small adjustment when BFI is (% of GDP) between -1.5 and -0.5; - Very tight or a strong adjustment when BFI is (% of GDP) less than 1.5.
McDermott and Wescott (1996)	An episode of significant fiscal consolidation is defined as one in which the fiscal balance (the ratio of the primary structural government balance to potential GDP) improves by at least 1.5 percentage points over two years and does not decrease in either of the two years. An episode of significant fiscal stimulus is defined as a period in which the primary structural fiscal balance declines by at least 1.5 percentage points over two years without increasing in either of the two years.
Alesina and Ardagna (1998)	A period of fiscal adjustment is a year in which the cyclically adjusted primary balance improves by at least 2% of GDP, or a period of two consecutive years in which the cyclically adjusted primary balance improves by at least 1.5% of GDP per year, in both years. This definition of fiscal adjustment is slightly different from the one used in Alesina and Perotti (1995), which treats two consecutive years of 'tight' policy as a single episode).
Miller and Russek (1999)	A trigger point exists when the key variable (debt-to-GDP ratio, cyclically adjusted primary deficit) in a given year, exceeds its mean plus one standard deviation.
Giavazzi, Jappelli and Pagano (2000)	A large and persistent fiscal impulse is one in which the full employment surplus (as a percent of potential output) changes by at least 1.5 percentage points per year over a two-year period.
Heylen and Everaert (2000)	A period of fiscal adjustment is any period starting with an improvement of the budget balance by at least 0.25% points in the first year, a minimum duration of 2 years and a total improvement of budget balance by at least 2% points.
Von Hagen et al. (2002)	A fiscal consolidations as Episodes in which either the cyclically adjusted (total) government budget balance increased by at least 1.25% of cyclically adjusted GDP in two consecutive years, or the cyclically adjusted budget balance increased by at least 1.5% of cyclically adjusted GDP in one year and was positive but perhaps less than 1.25% in both the preceding and the subsequent year.' The consolidation episode is said to end when the cyclically adjusted primary deficit deteriorates in a given fiscal year.
Ahrend, Catte and Price (2006)	Episodes of Fiscal consolidation are those that starting when the cyclically adjusted primary balance (CAPB) increases by at least 1 percentage point of GDP (in one year or over two consecutive years with at least ½ point in the first year).

[7] It is worth mentioning that where the definitions of « fiscal stimuli episodes" are not explicitly provided by the authors and thus reported here by us, we can consider that fiscal stimuli episodes are defined symmetrically as that of "fiscal consolidation", but inversely.

Ardagna (2007)	A period of fiscal adjustment is a period in which the cyclically adjusted primary balance improves by at least 2% of GDP, or a period of two consecutive years in which the cyclically adjusted primary balance improves by at least 1.5% of GDP per year, in both years.
Guichard, Kennedy, Wurzel and Andre (2007)	An episode starts if the cyclically adjusted primary balance (CAPB) improves by at least one percentage point of potential GDP in one year or in two consecutive years with at least ½ percentage point improvement. An episode continues as long as the CAPB improves. An interruption is allowed without terminating the episode as long at the deterioration of the CAPB does not exceed 0.3 per cent of GDP and is more than offset in the following year (by an improvement of at least 0.5 per cent of GDP). An episode t*erminates* if the CAPB stops increasing or if the CAPB improves by less than 0.2 per cent of GDP in one year and then deteriorates.
Alesina and Ardagna (2010)	A period of fiscal adjustment (stimulus) is a year in which the cyclically adjusted primary balance improves (deteriorates) by at least 1.5 per cent of GDP.
European Commission (2010)	A fiscal consolidation occurs when the CAPB improves by at least 1.5% with such an increase taking place in one single year (cold shower) or over three years (gradual consolidation) if each and every year the cyclically adjusted primary balance (CAPB) does not deteriorate by more than 0.5% of GDP.
IMF (2010)	The Episodes are selected using the Action Based Approach that consists of Identifying the policy actions motivated by deficit reductions: examination of accounts and records (in OECD Economic surveys, IMF Staff Reports, IMF Recent Economic Developments Report, Country Budget documents and additional country specific sources) of what countries actually did.

Source: The Author's compilation

Table 3: Summary of findings on Fiscal Episodes

Study	Sample (Period of Study)	Indicator of Fiscal Stance	Number of Fiscal Episodes identified
IMF (1993, 1995)		IMF primary structural budget balance	
Giavazzi and Pagano (1995)	19 OECD countries (1970-1992)	OECD primary structural budget balance	223 Episodes of contractions.
Cour et al (1996)	17 OECD countries (1970-1995)	OECD primary structural budget balance	19 Episodes of fiscal contractions and 18 Episodes of fiscal expansions.
OECD (1996)		OECD primary structural budget balance	
Alesina and Perotti (1995a and 1996)	20 OECD countries (1960-1994) – but excluded Switzerland for identification of fiscal episodes.	Blanchard Fiscal Impulse	66 Episodes of very tight policy (Strong Adjustments) and 65 Episodes of very loose fiscal policy (Strong expansion).
McDermott and Wescott (1996)	20 OECD countries (1970-1995)	OECD primary structural budget balance	74 episodes of large adjustments and 74 episodes of large stimuli.
Alesina and Ardagna (1998)	All OECD Countries (1960-1994)	Blanchard Fiscal Impulse	51 Episodes of tight policy
Miller and Russek (1999)	19 OECD countries (1970-1996)	OECD primary structural budget balance	22 contractions and 19 expansions.
Giavazzi, Jappelli and Pagano (2000)	18 OECD Countries (1970-1996); 101 Developing countries (1970-1994)	OECD primary structural budget balance (Only large and persistent episodes).	For OECD Countries, 65 Episodes of contractions and 38 Episodes of fiscal expansions. For developing countries, 270 fiscal contractions and 259 fiscal expansions.
Heylen and Everaert (2000)	19 OECD Countries (1975-1995)	Estimation of a cyclically-adjusted primary balance expressed as a percentage of potential GDP.	39 Episodes of fiscal consolidation spread over 18 countries.
Von Hagen et al. (2002)	20 OECD Countries (1960 – 1998)	Estimation of cyclically adjusted GDP based on country-specific, linear-quadratic trends. OECD cyclically adjusted budget balance.	65 episodes of fiscal consolidation
Ahrend, Catte and Price (2006)	24 OECD countries from 1980-2005	OECD Cyclically adjusted primary balance	Not available
Ardagna (2007)	A panel of 25 OECD countries from 1970 to 2006	Blanchard Fiscal Impulse	86 episodes of fiscal consolidation
Guichard, Kennedy, Wurzel and Andre (2007)	24 countries from 1978-2005	OECD Cyclically adjusted primary balance	85 fiscales consolidations episodes.
Alesina and Ardagna (2010)	21 OECD countries from 1970 to 2007	Blanchard Fiscal Impulse	107 periods of fiscal adjustments, 65 last only for one period, while the rest are multiperiods adjustments. 91 episodes of fiscal stimuli with 52 lasting one period, and the rest are multiperiods adjustments.

European Commission (2010)	EU27 countries together with selected non-EU OECD countries during the period 1970-2005. Selected non-EU OECD countries include Australia, Canada, Japan, Mexico, Norway, Switzerland, Turkey and the US.	European Commission cyclically adjusted primary balance.	235 consolidation episodes with 160 consolidations episodes in EU, of which 116 in the EU15.
IMF (2010)	15 Advanced Economies (1980-2009)	Action Based Approach (Identification of policy actions motivated by deficit reductions).	136 episodes of Small fiscal consolidation (greater than 1.5% of GDP) and 37 episodes of Large fiscal contraction (greater or equal to 1.5% of GDP).

Source: The Author's compilation

Fiscal episodes (consolidations and stimuli) result from the attempts of the governments to change the budgetary position of the government: fiscal consolidations or stabilizations aim at adopting discretionary fiscal policies that cut budget deficits whilst fiscal stimuli consist of discretionary fiscal policy that increase budget deficits. To identify fiscal episodes, we need to compute a measure of fiscal impulse. The fiscal impulse is a discretionary change in the budgetary position and can be measured as the difference between the actual budgetary position and what would prevail under a benchmark cyclical situation (Alesina and Perotti, 1995a).

As mentioned by Alesina and Perotti (1995a), having an interest in discretionary changes in fiscal policy means eliminating from the budget balance two components:

-the interest payments, which cannot be directly influenced by government policies;

-the cyclical component of the budget (that is, excluding changes in economic activity such as the effects of automatic stabilisers or the effects of inflation from the budget balance).

The first adjustment implies the use of the primary surplus (or deficit), whilst the second correction is more problematic. This is why there exists several ways in the empirical literature to deal with this issue:

- one possibility is to ignore the existence of the cyclical component in the primary budget balance and consider the change in primary deficit as the measure of fiscal impulse. According to Alesina and Perotti (1995a), this procedure is not totally unreasonable if the focus is on very large (absolute) values of the fiscal impulse, that is, very large reductions or increases in deficits. They justify this argument by the fact that considering only "large" observations would not be unduly influenced by cyclical effects: for example, when even a large change of the fiscal balance is caused by exogenous factors, such as a supply shock, or a

shock in "animal spirits", but most cyclical fluctuations are of relatively moderate magnitude (Alesina and Perotti 1995a:P5).

- the second option is to use the cyclically adjusted budget deficits provided by the OECD or the IMF. The first defines the fiscal impulse as the difference between the current primary deficit that would have prevailed if expenditures of the previous year had grown with potential GDP and if previous year's revenues have grown with actual GDP. The IMF measure is similar, but assumes as the benchmark year not the previous year but a reference year when the potential output was close to actual output. Although these two measures are relatively simple and widely used, they have the drawback to rely upon somewhat arbitrary measures of "potential output" and base years.

- the last option is the one suggested by Blanchard (1993). This approach is more attractive to the extent that it does not require a measure of potential output for computing the primary surplus (deficit) corrected for cyclical components. This measure consists in calculating how the budget balance would be in a certain year, if unemployment had not changed from the previous year: this cyclical adjustment is an attempt to eliminate from the budget balance changes in taxes and transfers induced by changes in unemployment, when tax-transfers laws remained unchanged.

Formally, one should apply the following procedure to the components of the primary budget balance, i.e., transfers and revenues[8] that are more sensitive to changes in unemployment: for example, transfers are first regressed on a two time trend and the unemployment rate. The estimated parameters are used to compute what the transfers would be in period t if unemployment were the same as in the previous year. The same procedure applied also to each other sensitive components of total revenues. Having then constructed Transfers (U_{t-1}) and Total Revenues (U_{t-1}), the primary deficit that would have prevailed in period t, had the unemployment rate remain equal to its period (t-1) level, is derived.

Once the fiscal impulse measure is calculated, we need a rule to identify the fiscal episodes. The criteria used in the existing literature to identify these episodes differ slightly from paper to paper. Table 4 describes these different measures of fiscal impulse available in the empirical literature. In this study, we apply the original definitions of Alesina and Perotti (1995), which has been re-employed recently in Ardagna and Alesina (2010) and is also widely used in practice. According to these definitions,

[8] Though on the spending side, Alesina and Perotti (1995b) have shown evidence that results are virtually unchanged if the procedure is applied to total spending, rather than transfers alone.

- *"**A period of fiscal adjustment is a year in which the cyclically adjusted primary balance improves by at least 1.5 percent of GDP**".*

- *"**A period of fiscal stimulus is a year in which the cyclically adjusted primary balance deteriorates by at least 1.5 percent of GDP**".*

Thus, we use the episodes of fiscal adjustments and stimuli identified by Ardagna and Alesina (2010) to examine their effects on aid efforts: the authors focus upon a sample of 21 OECD countries with data spanning over 1970-2007. The countries included in their sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. However, in our database, we exclude Greece and Switzerland because these countries have significantly short panels, though our results do not change if we include them.

Relying on large changes in fiscal policy stance, especially on the reductions and increases of budget deficits, Alesina and Ardagna (2010) use Blanchard (1993)'s indicator of fiscal impulse (changes in the cyclically adjusted primary balance) to identify the fiscal episodes. This indicator is simpler and more transparent than other indicators such as the OECD measure and corrects various components of the government budget for year to year changes in the unemployment rate. More precisely, the change in the cyclically adjusted value of a fiscal variable is the difference between a measure of that fiscal variable in period *t* computed as if the unemployment rate were equal to the one in $t-1$ and the actual value of the fiscal variable in year t-1[9]. Overall, Alesina and Ardagna (2010) identify 107 periods of fiscal adjustments and 91 periods of fiscal stimuli. The majority of fiscal episodes lasted only one year, i.e. 65 adjustments epsiodes and 52 stimuli episodes, while the remaining episodes were multi-year episodes. Table 5 lists the episodes (years) of fiscal consolidation and fiscal stimuli identified by Alesina and Ardagna (2010).

[9] To calculate the measure of the fiscal variable in period *t* as if the unemployment rate were equal to the one in $t-1$, the authors follow the procedure in Alesina and Perotti (1995). Specifically, for each country in the sample, they regress the fiscal policy variable as share of GDP, on a time trend and on the unemployment rate. Then, using the coefficients and the residuals from the estimated regressions, they predict what the value of the fiscal variable as a share of GDP in period t would have been if the unemployment rate were the same as in the previous year.

Table 4: Summary on the main measures of Fiscal Impulse

The Fiscal Impulse is the discretionary change in budgetary position and can be measured as the difference between the actual budgetary position and what would prevail under a benchmark cyclical situation. There is no universally accepted method which defines what part of the current budgetary position reflects an exogenous action from the government and what part is merely a reflection of the cycle. The measures presented here try to take into account two important issues: 1°) What benchmark situation is used to adjust the actual measure? 2°) What parts of the budget should be adjusted to this benchmark and how? For instance, should interest payments be adjusted for inflation, and if so, how? (Alesina and Perotti, 1995).			
Measure of Fiscal Impulse	**Formula**	**Description**	**Advantages and drawbacks of each measure**
Change in Primary deficit ($\Delta \Pr imarydeficit$)	$FI = (g_t - t_t) - (g_{t-1} - t_{t-1})$ *The fiscal impulse is the change in the primary deficit as a share of GDP from the previous year (the primary deficit excludes interest expenditures).*	g_t is the total current expenditure plus gross capital accumulation minus interest payments as share of GDP and t_t represents the total revenues as share of GDP.	This measure takes the previous year as the benchmark year. Although this measure is simple, it ignores the cyclically induced fluctuations in the primary deficit. However, this measure can be a good approximation as long as expenditures and revenues are closed to being unit elastic to GDP. Indeed, if the endogenous component of all revenues and expenditures were unit elastic to actual GDP, this measure would identify all and only discretionary changes in fiscal policy.

The Blanchard Fiscal Impulse	$FI = (g_t(U_{t-1}) - t_t) - (g_{t-1} - t_{t-1})$ *This measure estimates what government outlays and revenues would be in any given year if the unemployment rate had remained the same as in the previous year.* *In practice, the Blanchard method consists of extracting cyclical movements in the primary balance by using individual regressions for each component of the primary balance. In other words, for each country, each primary balance component is regressed on a specific unemployment rate and a set of deterministic variables that are a constant, and a deterministic trend. Predicted values conditional on the previous year's unemployment rate (i.e. by replacing the contemporaneous unemployment rate with its lagged value in the estimated equations) are then calculated for revenues and transfers. This allows us to compute a predicted primary balance based on an unchanged unemployment rate. The Blanchard measure of the structural fiscal impulse is then calculated by subtracting the predicted cyclically adjusted primary balance from its actual value.*	U_t is employment rate in year t. g_t and t_t are defined as previously.	This measure takes the previous year as the benchmark year. It is simple does not rely on estimates of potential output. It takes into account the fact that the deficit can rise endogenously during recessions (outlays can be negatively related to GDP – because of built in stabilizers like unemployment compensation- and revenue can be positively related to GDP – because for instance of the progressivity of tax systems.
The OECD Fiscal Impulse or "Dutch measure"	$FI = [(G_t - T_t) - (G_{t-1}(I + \tilde{y}_t) - T_{t-1}(1 + y_t))] / \Upsilon_{t-1}$ *The fiscal impulse is the difference between the current primary deficit and the primary deficit that would have prevailed if expenditure in the previous year had grown with potential GDP, and revenues in the previous year had grown with actual GDP.*	G_t is the total current expenditure plus gross capital accumulation minus interest payments ; T_t represents the total revenues as share of GDP; $\tilde{y}_t$ is the rate of growth of nominal potential GDP; y_t is the rate of growth of nominal GDP ; Υ_{t-1} is the nominal GDP.	Like the first two measures, the OECD Fiscal Impulse takes the previous year as the benchmark year. It is more complex than the previous ones, but is sensitive to inflation in a subtle way.

The IMF's Fiscal Impulse	$FI = [(G_t - T_t) - (G_0(1+\tilde{y}_t) - T_0(1+y_t))] / \Upsilon_{t-1}$ *The fiscal impulse is the difference between the current primary deficit and the primary deficit that would have prevailed if expenditure in a reference year where potential output was close to actual output had grown with potential GDP, and revenues had grown with actual GDP.*	G_0 is the value of G in base year and T_0 is revenue in base year. The others variables are the same as above.	This measure, in contrast with the previous ones does not consider the benchmark year as the previous. It rather considers a reference year where the potential output was close to actual output. However, it seems to the OECD's measure aside from the difference in benchmark treatment.
The Economic Commission Fiscal Impulse	The cyclical adjustment method used by the Commission services (European Commission, 1995) to calculate the cyclically adjusted balances involves two main steps: - first, trend output is estimated, applying the Hodrick-Prescott filter (Hodrick and Prescott, 1980; Prescott, 1986). Estimates of the cyclical fluctuations are obtained by subtracting these trend output estimates from actual output. - secondly, the effects of these output gaps on government budget receipts and expenditure are calculated via the use of revenue and expenditure elasticities. These cyclical effects are then deducted from the actual government budget balance to obtain the cyclically adjusted budget balance. Bruni and Tujula (1999) compare the Blanchard and HP methods and judge the Blanchard method to be superior in identifying periods of tight fiscal stance that accord with the consensus of commentators.		

Source: The Author's compilation

Table 5: The Episodes of fiscal adjustments and Stimuli identified by Ardagna and Alesina (2010)

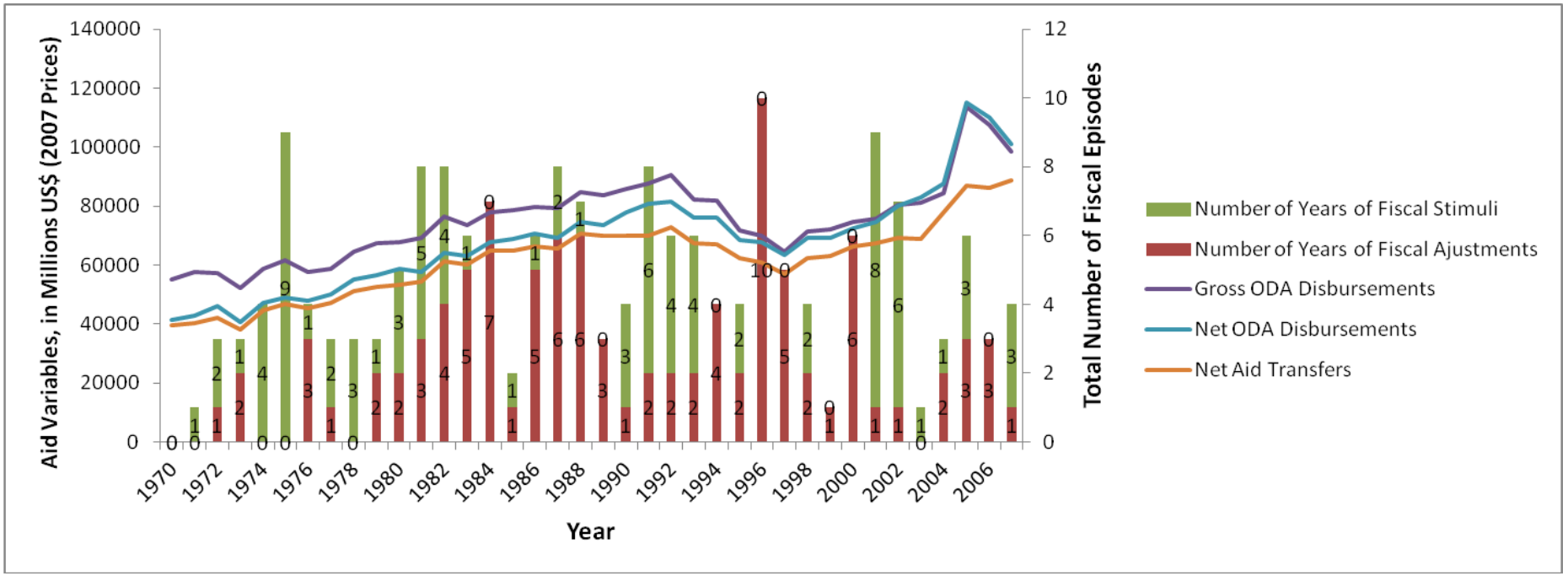
Country	Episodes of fiscal adjustments	Episodes of fiscal Stimuli
Australia	1987 1988	1990 1991
Austria	1984 1996 1997 2005	1975 2004
Belgium	1982 1984 1987 2006	1975 1981 2005
Canada	1981 1986 1987 1995 1996 1997	1975 1982 1991 2001
Denmark	1983 1984 1985 1986 2005	1974 1975 1980 1981 1982
Finland	1973 1976 1981 1984 1988 1994 1996 1998	1978 1982 1983 1987 1990 1991 1992
France	1979 1996	1975 1981 1992 1993 2002
Germany	1996 2000	1995 2001
Greece	1976 1986 1991 1994 1996 2005 2006	1981 1985 1989 1995 2001
Ireland	1976 1984 1987 1988 1989 2000	1974 1975 1978 2001 2007
Italy	1976 1980 1982 1990 1991 1992 1997 2007	1972 1975 1981 2001
Japan	1984 1999 2001 2006	1975 1993 1998 2005 2007
Netherlands	1972 1973 1983 1988 1991 1993 1996	1975 1980 1995 2001 2002
New Zealand	1987 1989 1993 1994 2000	1988
Norway	1979 1980 1983 1989 1996 2000 2004 2005	1974 1976 1977 1986 1987 1991 1998
Portugal	1982 1983 1986 1988 1992 1995 2002 2006	1978 1985 1993 2005
Spain	1986 1987 1994 1996	1981 1982 1993
Sweden	1981 1983 1984 1986 1987 1994 1996 1997	1974 1977 1979 1980 1991 1992 2001
United Kingdom	1977 1982 1988 1996 1997 1998 2000	1971 1972 1973 1990 1991 1992 2001
United States		2002

Source: Alesina and Ardagna (2010)

The figure 1 below plots the evolution of the three aid variables used in this study : the gross aid disbursements in percentage of GDP –ODAGross-, the net aid disbursements in percentage of GDP –ODANet-, and the net aid transfers in percentage of GDP of Roodman (2008) denoting NAT. The ODAGross measures the total aid disbursements over a given accounting period; ODANet represents gross amount of aid disbursements minus the repayments of loan principal or recoveries on grants received during the same period; NAT subtracts not only the repayments of principal from ODAGross, but also interest payments and the cancellation of non-ODA loans (that is, debt relief). The exclusion of debt relief from the definition of aid is justified by the fact that debt cancellation does not give rise to an actual disbursement of funds and may even imply a double counting of aid if the debt that is cancelled was granted on a concessional basis (see also Bertoli et al, 2008). Accordingly, the NAT variable appears to approximate more closely the current budgetary outlays associated with aid (see also Dang et al, 2010).

The evolution of each of these three aid variables is compared with the total number of fiscal episodes per each year (both fiscal consolidation and fiscal stimuli episodes) of OECD DAC.

Figure: Aid Variables and the Number of Fiscal Episodes, per year.



Source: The number of fiscal episodes is calculated by the Author based on Alesina and Ardagna (2010)' data on fiscal episodes. This is the total number of fiscal consolidation or fiscal stimuli years for all OECD countries and per each year of our period of study. The Data related to aid variables stem from OECD Economic Outlook N° 88 – December 2010 as well as Roodman (2008)' statistics.

Overall, the aid variables tend to decline particularly for high levels of fiscal adjustments, though this evolution hides many disparities among countries regarding their aid export during fiscal episodes, especially fiscal adjustments. Before presenting the econometric specification, we find it useful to perform a simple two-sample t-test on mean difference with unequal variances. This test allows us to explore whether aid is higher/lower on average during fiscal stimuli/consolidation episodes. In other words, we compare through a t-student test the means of aid variables (the three different types of aid variables are considered here) during fiscal consolidation episodes/fiscal stimuli episodes to their respective means during the episodes of the absence of fiscal consolidation/fiscal stimuli. Whatever aid variable considered (ODAGross, ODANet and NAT), we observe that:

- there is no (statistically significant) difference between the amount of aid disbursed during large fiscal consolidation episodes and aid disbursed during the episodes where donors do not implement large fiscal consolidation measures. The P-values of the t-test on mean difference with unequal variance are respectively 0.019, 0.019 and 0.015 for the variables ODAGross, ODANet and NAT.

- the amount of aid disbursed during large fiscal stimuli episodes is statistically higher than the amount of aid disbursed during the episodes where donors do not implement large fiscal stimuli measures. In fact, the P-values of the t-test on mean difference with unequal variance are respectively 0.45, 0.27 and 0.23 for the variables ODAGross, ODANet and NAT.

Furthermore, to have a first look at the response of the aid flows to the episodes ("before", "during" and "after") of fiscal consolidations and stimuli, we regress the aid variables on dummy indicators for periods "before", "during" and "after". Thus, we estimate the following equations:

$$Aid_{it} = \alpha_i + \lambda_1 BeforeConsolidation + \lambda_2 Consolidation + \lambda_3 AfterConsolidation + \lambda_4 BeforeStimuli + \lambda_5 Stimuli + \lambda_6 AfterStimuli + \varepsilon_{it}$$

where the "aid variable" is alternatively the gross aid disbursements in percentage of GDP (ODAGross), the net aid disbursements in percentage of GDP (ODANet), and the net aid transfers in percentage of GDP (NAT) (these "aid" variables are described in the Appendix 1); i denotes the country's index: i = 1,..,19, and t denotes the time period index: t =

1970,...,2007. λ_1, λ_2, λ_3, λ_4, λ_5 and λ_6 are parameters to be estimated and α_i is specific-country effects. ε_{it} is an error term. "BeforeConsolidation" and "BeforeStimuli" are dummy variables taking the value of "1" the year before the fiscal episode starts in a donor country and "0" otherwise, for respectively episodes of fiscal adjustments (consolidations) and stimuli (expansions).

"AfterConsolidation" and "AfterStimuli" are dummy variables that take the value "1" the year after the last year of the fiscal episode in a donor country (e.g., if a fiscal episode lasts 4 years, we associate the value "1" to the fifth year) and "0" otherwise for respectively episodes of fiscal adjustments (consolidations) and stimuli (expansions).

"Consolidation" and "Stimuli" are the variables indicating respectively the episodes of fiscal consolidations and fiscal stimuli.

We use as estimation technique the panel fixed effects[10]. The results (in Table 6) of the estimations indicate that a one year after the fiscal consolidation induces the decline of donors'aid effort, irrespective of the "aid variable" used. For the other variables of the model, we do not find a significant effect, except for the "beforeStimuli" variable where the results indicate that aid supply is reduced the year following the start of fiscal stimuli episodes. This may be because we have not controlled for other explanatory variables and/or we haven't used the appropriate technique to deal with possible serial correlation and contemporaneous correlation of errors. However, this does not matter at this stage of the study, since the objective here is to have a first idea of the effects of fiscal episodes on aid disbursements. The next section is devoted to the specification of the model.

[10]Fixed effects model (FE) appears as the logical econometric specification for having a first look on the effect of fiscal consolidation variables on aid disbursements. The reasons are very simple: first, Fixed effects allow us to capture unmeasured state-invariant factors influencing aid in percent of GDP. Second, the countries in our sample constitute, in principle, the whole population of the donor countries, so it is appropriate to treat the individual effects as fixed rather than random.

Table 6: Fixed effects panel data estimates of the response of aid flows to fiscal episodes

	Model with "ODAGross"	Model with "ODANet"	Model with "NAT"
Estimator	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*
Variable			
BeforeConsolidation	-0.00349	0.00171	0.00245
	(0.0127)	(0.0117)	(0.0119)
Consolidation	-0.0224**	-0.0191*	-0.0192*
	(0.0110)	(0.0106)	(0.0105)
AfterConsolidation	-0.0136	-0.0132	-0.0140
	(0.0119)	(0.0119)	(0.0116)
BeforeStimuli	-0.00480	-0.0148	-0.0288*
	(0.0184)	(0.0168)	(0.0162)
Stimuli	0.000899	-0.00193	-0.00577
	(0.0156)	(0.0150)	(0.0147)
AftereStimuli	0.0165	0.00785	-0.00845
	(0.0160)	(0.0150)	(0.0148)
Constant	0.363***	0.342***	0.344***
	(0.0320)	(0.0378)	(0.0389)
Countries - Observations	19-645	19-653	19-653
R-squared	0.837	0.845	0.845
Year dummy Significance	Yes	Yes	Yes

Notes: Figures in parenthesis are standard errors of the coefficients; The "areg" command in Stata is used to correct the heteroscedasticity in errors; Time effects are included in the regressions; ***, **, and * indicate statistical significance at 1%, 5% and 10%, respectively.

4. Econometric Specification

4.1 The Model

We follow a general approach that consists of estimating a version of the following equation:

$$A_{i,t} = \alpha_i X_{it} + \beta_i Z_{it} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

where i denotes the countries (i = 1,..., 19) and t denotes years (t = 1970,..., 2007) and the dependent variable $A_{i,t} = (Aid/GDP)_{i,t}$ denotes the total aid flows (bilateral and multilateral) from country i in year t. As stipulated above, we use as our dependent variables three different measures of aid flows disbursed by each donor: the gross aid disbursements as a percentage of GDP (denoting ODAGross), the net aid disbursements as a percentage of GDP (ODANet) and the net aid transfers (NAT) measure from Roodman (2008)[11] also as a percentage of GDP.

The vector $X_{i,t}$ represents the fiscal episode variables that include episodes of fiscal consolidation and episodes of fiscal stimulus. These variables are included in all our regressions. Furthermore, they are replaced by two variables: the number of years since fiscal

[11] See Centre for Global Development and data described in Roodman (2008, 2012).

consolidation started in a donor country as well as its square; the number of years since fiscal stimulus started in a donor country as well as its square.

The vector $Z_{i,t}$ comprises two kinds of time-varying control variables derived from the empirical literature:

- A set of time-varying control variables is included in all regressions: the fiscal balance (percentage of GDP), the gross public debt as a percentage of GDP and the output gap. These variables combined with the fiscal episode variables form our baseline regression model.
- For a first robustness check of our results, we also use a set of time-varying and non-varying control variables derived from the empirical literature that are included once in the baseline model: the degree of trade openness; a variable capturing the ideological orientation of the government; the quality of bureaucracy; the independence of the aid agency; the population level; the real effective exchange rate; banking crises; the unemployment rate; the inflation rate; the Cold War, the welfare institutions and the voting similarity index in the United Nations General Assembly (UNGA). All these variables are described in the Appendix. As shown later, the coefficients of our variables in the baseline model are not significantly affected by the inclusion of the vector $Z_{i,t}$ of control variables (for the robustness check).

μ_i are donor fixed effects that are incorporated in the model to capture the heterogeneity among countries as well as the likely importance of unobservable effects correlated with the error term in determining aid flows. The use of fixed effects μ_i in our regressions is dictated by several considerations: first, since our sample is composed of heterogeneous countries, there are likely to be state-invariant and unmeasured factors correlated with the error term in determining aid flows. Second, the number of time periods is significantly higher than the cross-section dimension of our panel. Furthermore, our macro panel contains, in principle, most countries of interest (representing the whole population of the OECD donor countries), and thus is not likely be a random sample from a much larger universe of countries. η_t are year dummies and are included in all specifications to account for common shocks to aid volume in any given year.

The disturbance $\varepsilon_{i,t}$ is assumed to be independently and identically distributed (i.i.d.; $0, \sigma_{\varepsilon}^{2}$), that is, it is assumed not to be correlated with the explanatory variables of the model and its normality is not required (Baltagi, 2002).

Should our supply equation of aid flows have a dynamic specification? Wildavsky (1964) points out that the current year's spending in any public agency is predominantly influenced by the budget of the previous year. Mosley (1985) reinforces this argument by stressing that it is particularly true for aid agencies since aid projects often run over several years, with financial flows being committed in year one.

To explore this likely dynamic specification statistically, we follow the procedure suggested by Maddala (1987) and Anderson and Hsiao (1982). This procedure, described in the Appendix, refers to a Wald test to study if the lagged dependent variables have a direct effect on the dependent variable, apart from the indirect influence generated by serial correlations of the errors. If this is the case, then the model can be termed 'state-dependent' or 'system dynamic' and if not, it can be termed 'serial correlated' or 'error dynamic'.

To perform the test, we use two lags of the dependent variable because additional lags appear not to be significant. The results are presented in Table 7 and are further interpreted in section V. Accordingly, we estimate the model specification described previously with two lagged dependent variables. While it is well-known that the fixed-effects estimator generates biased results in a dynamic panel, Nickell (1981) proves that this bias decreases over a number of time periods and approaches zero as T (the time period) approaches infinity (the time dimension of the panel is large). Accordingly, as our time dimension is T=38 and our cross-sectional dimension is N= 19, we choose to work with fixed effects.

In the next section, we discuss the expected sign of the different regressors included in the model.

4.2 Expected signs of the variables

Before proceeding to the evaluation of the empirical results, we first discuss the expected effects of the explanatory variables on the aid effort.

Fiscal consolidation episodes

During episodes of large fiscal consolidations, governments tighten their budgets and reduce high debt levels to make public finances sustainable. Therefore, we can expect governments

to reduce several items of expenditure including spending on aid flows despite their firm commitment to increase aid exports to recipient countries.

However, as Round and Odedokun (2004) point out, since 'aid can act as an immense foreign policy tool for donor governments, it is not a particular discretionary item in the budget' (p.306); thus, it may not be reduced even in the case of the deterioration of public finance situations. Although this argument runs counter to the expectation of a procyclical pattern of foreign aid (Hallet, 2009), we can also expect aid expenditures to be protected during episodes of fiscal consolidation. In other words, large fiscal consolidations can exert a positive effect on aid flows.

In addition, we also assume that governments will reduce expenditure on several items in the face of competing government expenditures, but that they will maintain or increase aid exports for strategic, geopolitical or international political economic reasons: aid could be protected even when spending is being constrained (Round & Odedokun 2004).

Fiscal stimulus episodes

During large-scale fiscal stimulus episodes that aim to stimulate domestic activity, aid expenditures may decrease (this is considered a discretionary component that is cut in favour of social and investment spending), or may increase as do other discretionary components of expenditure, or may neither increase nor decrease.

The budget deficit and the public debt

As in Mosley (1985), Round and Odedokun (2004), Faini (2006) and Bertoli et al (2008), we hypothesize that cases of a weaker fiscal position, characterized by larger budget deficits and high levels of public debt, will ceteris paribus lead to a reduction in the level of discretionary spending, especially that of aid flows, because of strong pressures to reduce deficits and public debt and preserve scarce foreign currency. In other words, a healthy fiscal position will be associated ceteris paribus with higher spending, including spending on official development assistance (ODA).

In the same way, Bertoli et al (2008) highlight the fact that regardless of the level of public spending, policymakers face competing claims on public resources because of high debt servicing, public investment and military expenditures. For example, Boschini and Olofsgard (2007) observe a positive relationship between aid flows from Development Assistance Committee (DAC) member countries and military expenditures and argue that aid

was used as a strategic instrument during the Cold War period. Despite the empirical difficulties in identifying the true relation (as the intentions of donors are not made explicitly), we could argue, following Bertoli et al (2008), that 'given the small volume of aid relative to GDP, it is the overall level of public expenditures rather than its allocation among different expenditures chapters that influences the volume of aid' (see also Faini, 2006).

However, in contrast to this hypothesis, in accordance with Bertoli et al (2008), we can also assume that weak budgetary positions – or significant debt overhang – may not have a detrimental impact on foreign aid provided that governments adopt an accommodating attitude towards the fiscal disequilibria over the medium term.

The output gap

The effect of the output gap (the difference between the maximum output achievable and the actual level of output) can be either positive or negative as a positive output shock may not necessarily lead to higher aid expenditures.

The number of fiscal consolidation episodes

We introduce a counter variable (replacing the variable 'Consolidation') (see also Dang et al, 2010, for the same procedure with regard to the 'banking crisis variable') in our model to capture the effects of fiscal consolidation: the 'number of years of fiscal consolidation'. This variable records for a given country the number of years since the first year in which a fiscal consolidation occurred, with the first year taking a value of 1 and all years subsequent to the fiscal consolidation end year taking the value of 0. To allow the effect to diminish over time, we include this counter variable in both linear and square terms in the model. In other words, we expect a negative effect of the counter variable 'number of years of fiscal consolidation' but a positive effect of its square terms.

The number of fiscal stimulus episodes

The construction of this variable follows the same procedure as for the variable 'number of years of fiscal consolidation', the difference here being that this variable records for a given country the number of years since the first year of the occurrence of a fiscal stimulus. This variable takes the value of 1 for the first year, 2 for the second year, etc. and the value 0 for all years subsequent to the fiscal stimulus end year. To allow the effect to diminish over time, we

also include this counter variable in both linear and square terms in the model. In other words, we expect a positive, neutral or even a negative effect of this counter variable.

The degree of openness

In the literature on aid allocation and growth, aid depends on the economic characteristics of recipient countries: it can be used as a tool to influence the economic policies of recipients, especially the openness of the recipient economy to international trade (Alesina & Dollar, 2000; Heron, 2008; McKinlay & Little, 1978). Thus, countries that rely more on trade may see foreign aid as a useful tool to promote trade and hence increase their aid effort.

We follow Boschini and Olofsgard (2007), Dang et al (2009), Dustin (2010) and Sam (2011) and include in our model a trade integration variable. We use (as do, for instance, Dang et al, 2010; Dustin, 2010; Sam, 2011) a measure of how exposed a country is to trade openness: (Exports + Imports)/GDP. Other measures are also available in the empirical literature and include, for example, export orientation measured by (Exports/(Exports + Imports)) or the proportion of years a country is open (the indicator used by Sachs & Warner, 1995) as a proxy for the degree of economic openness.

The ideological orientation of the government

The empirical literature on development aid supplies has posited that ceteris paribus, right-wing regimes in donor countries exhibit lower aid supplies compared to left-wing governments. However, the influence of a government's ideological orientation (social-democrat versus libertarian-conservative) on aid supplies is not clear-cut on the basis of aggregated aid data. Indeed, conservative governments may allocate more aid to promote national commercial interests, while progressive governments may provide a similar amount for altruistic reasons (Bertoli et al, 2008; Round & Odedokun, 2004).

The real effective exchange rate

It is expected that depreciation in the real exchange rate will, ceteris paribus, improve the balance of payments and thus increase ODA.

Unemployment

Beenstock (1980) and Mosley (1985) underscore that when explaining aid expenditures, unemployment is one of the most important explanatory variables apart from the fiscal

balance, as there may be obvious incentives to cut aid expenditures and redirect funds towards domestic expenditures in times of fiscal problems. Thus, we expect unemployment to reduce the level of aid supplied by the donors.

The quality of governance

This is another way of measuring the role of political factors in aid supplies. The quality of governance is a composite index of corruption in government, bureaucratic quality and the rule of law. We expect a better quality of governance in a donor's country to be associated with higher aid supplies.

The independence of aid agencies

We follow Isernia (1997) and Bertoli et al (2008) in arguing that aid exports may not be reduced during fiscal episodes if they are provided by an independent aid agency, rather than by the foreign affairs ministry or the prime minister's office, these latter being institutions that are more exposed to conflicting demands for funds (Bertoli et al, 2008). The justification is that independent aid agencies may be less exposed to the whims of political electoral cycles and may not reduce aid expenditures during fiscal episodes (specifically fiscal consolidation). Moreover, they tend to show greater leadership in deciding which developing countries need aid and in elaborating meaningful development projects to propose to the recipient countries (Isernia, 1997). To test this, we interact this variable with our variables of interest.

Banking crises

A banking crisis in a donor country is expected to lead to a reduction in aid flows irrespective of its effect on other economic variables such as real GDP or the government budget. Indeed, according to Dang et al (2010), bank rescues and recapitalizations place massive new fiscal demands on the public sector; even if the government is eventually able to recoup many of the costs of these rescues through asset sales, the short-term effect is to worsen sharply the government's cash flow.

Inflation

Greater economic difficulties (for instance, a high level of inflation inducing macroeconomic instability effects) will lead to lower support for foreign aid programmes. Thus, we expect a negative effect of this variable on aid supplies.

Real GDP per capita

Aid over GDP is assumed to be a 'superior good', that is, the ratio of aid over GDP is expected to increase as the per capita income rises.

Population

According to Round and Odedokun (2004), an increase in population size is likely to be associated with greater population heterogeneity, loss of social cohesion and ceteris paribus, declining willingness to redistribute. There is support for this hypothesis to the extent that within the DAC member countries, the small countries – such as the Nordic countries – are more homogeneous and cohesive and have long maintained an altruistic and progressive attitude towards foreign aid.

The Cold War

This variable captures certain key miscellaneous qualitative time-related factors that affect aid supplies. The empirical literature highlights the fact that aid has plummeted since the early 1990s due to the end of the Cold War among other factors. Indeed, the emergence of Eastern European countries from the early 1990s has created competition for aid with the conventional developing countries and provides greater freedom to donors to reduce aid on the basis of concerns about governance issues, something to which they had to turn a blind eye during the Cold War era (see Hjertholm & White, 2000; Round & Odedokun, 2004).

Welfare state institutions

Therien and Noel (2000) argue that the influence of partisanship is indirect and operates through other policies such as social-democratic welfare state institutions and social spending. Hence, the influence of political parties is only cumulative and operates indirectly through welfare institutions: strong welfare institutions best explain foreign aid spending patterns. However, Therien and Noel (2000) argue that welfare state institutions are relatively fixed, but this argument has recently been disputed by scholars who find that the earlier measures are deceptively static (Allan & Scruggs, 2004). We follow Tingley (2010) and use Scruggs' (2006) 'generosity' measure which is a time-varying measure of welfare state institutions (changes in welfare state institutions). This measure relates to comprehensive documentation of the welfare state institutions of OECD countries. Thus, a higher score on the 'generosity' measure indicates more comprehensive welfare state institutions.

While there is support for the positive role of liberal/conservative ideological parties in the 'generosity' measure, some authors, such as Pierson (1996), argue that this party effect has become small or non-existent. Hence, we can suppose that this welfare state measure ('generosity') provides a harder test for the party ideology variable (see also Tingley, 2010).

The voting similarity index in the General Assembly (GA) of the United Nations

Apart from pursuing economic self-interests (captured through the introduction in our model of economic variables related to donors' economies), donor countries can also pursue political self-interests. One might consider, in line with the empirical literature,[12] that aid is used as an instrument to induce recipients to vote in line with the donor country in the General Assembly of United Nations due to bilateral pressure and/or the fact that UN voting is considered relevant by the donor in defining bilateral relationships and foreign policy, which is the case of the United States (see, for example, Dreher et al., 2008). A proxy of donors' political self-interests that tends to be used in the literature is a recipient country's voting behaviour in the GA (see the Appendix for the details regarding the computation of this variable). We use this indicator in our study to see whether it affects the coefficients of our variables of interest.

5. The Data and the econometric methodology

5.1 The Data

We define and describe here the 'aid' variable as well as the fiscal episode variables used in our model. The other explanatory variables are described in the Appendix. The model is estimated on a sample of 19 countries, with data covering the period 1980–2007. Indeed, as we will see later, we consider the entire sample of Ardagna and Alesina (2010) but exclude Greece and Switzerland.

5.1.1 Dependent Variable: Aid data

In the empirical literature on the determinants of aid flows, several indicators of aid effort have been used: whereas some authors have used 'aid as a percentage of GDP' (for instance, Bertoli et al, 2008; Faini, 2006), a few studies have used overall aid as the dependent

[12] According to many empirical studies (see, for example, Alesina & Dollar, 2000; Barro & Lee, 2005; Kilby, 2009a, 2010, 2011; Thacker, 1999), developing countries get more aid and better conditions from donors when they have closer political ties with the donor as measured by their GA voting alignment.

variable (see, for instance, Boschini & Olofsgard, 2007; Dang et al, 2009) and others have employed the (log of) aid per capita (see, for instance, Frot, 2009).

For our main test, the dependent variable is net aid flow (as a percentage of GDP), which allows us to control for loan repayments. More particularly, we use the net disbursements of the ODA share of GDP. This comprises grants and loans with a grant element of at least 25%.

We then check for the robustness of our main results by considering additional variables of aid effort: gross aid disbursements (ODAGross) and net aid transfers (NAT) as described by Roodman (2008),[13] both as a percentage of GDP. The NAT concept subtracts out principal repayments as well as interest payments and the cancellation of non-ODA loans (i.e. debt relief). This variable more closely approximates the current budgetary outlays associated with ODA.

5.1.2 Fiscal Episodes Variables

Episodes of fiscal consolidation (and stimulus)

We use the variables constructed by Ardagna and Alesina (2010) according to their definition of 'fiscal adjustments and fiscal stimuli' (for more details, see the Appendix). These authors have focused on large changes in fiscal policy to identify episodes of fiscal adjustment and stimulus in OECD countries. Their definition results in the selection of 100 episodes of fiscal consolidation (13.8% of the observations in our sample) and 85 episodes of fiscal stimulus (11.8% of the observations in our sample) for 19 countries over the period 1970–2007.

Number of years since the start of fiscal consolidation (stimulus) in a donor country

These two variables are constructed following Dang et al's (2009) methodology related to banking crises (see the Appendix for the description of these variables).

[13] See the Centre for Global Development and data described in Roodman (2008, 2012).

5.2 Econometric methodology

5.2.1 Baseline econometric technique

In this part, we discuss the econometric technique suitable for estimating the effects of fiscal episodes on aid supplies. Consider the model (1) described above. We first impose the restrictions that $\alpha_i = \alpha$ and $\beta_i = \beta$, for i = 1,...,19.

Our baseline model specification is:

$$A_{i,t} = \alpha_1 Consolidation_{it} + \alpha_2 Stimuli_{it} + \beta_1 Fiscal\_Balance_{it} + \beta_2 Debt_{it} + \beta_3 Outputgap_{it} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (2)$$

where $A_{i,t}$ denotes ODAGross, ODANet or NAT variables as previously defined; Consolidation = episodes of fiscal consolidation (adjustment); Stimuli = episodes of fiscal stimulus (expansion); Fiscal_Balance = general government fiscal balances (total revenues minus total expenditures) in percentage of GDP; Debt = gross public debt-to-GDP ratio; Outputgap = the output gap; μ_i and η_t are respectively country-specific effects and temporal dummies as previously defined.

Pursuant to the discussion in sections 4.1 and 5.1.2 regarding the use of two variables as substitutes for the variables 'consolidation' and 'stimuli', we also estimate the following equation:

$$A_{i,t} = \alpha_{11}\text{NumberConsolidation}_{it} + \alpha_{12}\text{NumberConsolidationsq}_{it} + \alpha_{21}\text{NumberStimuli}_{it} + \alpha_{22}\text{NumberStimulisq}_{it} + \beta_1 Fiscal\_Balance_{it} + \beta_2 Debt_{it} + \beta_3 Outputgap_{it} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (2')$$

where NumberConsolidation, NumberConsolidationsq, NumberStimuli, and NumberStimulisq are, respectively, the variables indicating the number of years since the start of fiscal consolidation in a donor country and the square of this number; the number of years since the start of fiscal stimulus in a donor country and the square of this number. The other variables are those described previously in relation to equation (2).

The use of the fixed effects estimator (LSDV estimator) raises several issues, in particular:

- First, as the time dimension of our panel is large, there is likely to be serial correlation of errors (serial correlation for each individual through the time period), contemporaneous correlation between individuals and heteroscedasticity in the model. These problems are addressed through the use of appropriate correction techniques as described below.

- Second, as already discussed, even if the fixed effects method is often recommended in dynamic panels of our size (because the lagged dependent variables bias becomes less serious when T grows larger), there may still be a concern with regard to inconsistency due to the presence of fixed effects in a dynamic panel.

For panels with dimensions like ours, the econometric literature proposes the use of either the Parks–Kmenta feasible generalized least squares (FGLS)[14] estimator or Beck and Katz's (1995) panel corrected standard errors (PCSE) method. However, Beck and Katz (1995, 2001) have shown evidence that the PCSE method is not only more accurate than FGLS (when T>N), but it also performs well compared to the FGLS estimator (especially for T>15), pointing out that when FGLS are considered and tested, the standard errors are too optimistic. The PCSE enables us to deal with the problems of panel heteroscedasticity, autocorrelation and contemporaneous correlation. More specifically, it allows for the unit-specific AR1 term to correct for serial correlation. We primarily use the LSDV estimator with the PCSE technique to perform our regressions. Recognizing that the previous assumption of our model parameters' homogeneity ($\alpha_i = \alpha$ and $\beta_i = \beta$ and, for i = 1,..., 19) is strong, we relax it by examining the variation across different groups of countries and test to what extent the average effect varies according to the group of countries observed. Indeed, the average (common-mean) effects α obtained for the fiscal episode variables (Consolidation and Stimuli) as well as for the parameters β in equation (2) may hide variations among donor countries. The supplies of aid budgets reflect motives that go beyond the fiscal situations of the country and that can lead the donors not to reduce their aid expenditure during fiscal consolidation episodes. This may explain, as we have shown in the literature review, why there is no empirical consensus on the effects of fiscal variables on aid supplied by OECD DAC countries. Moreover, the aid allocation literature provides evidence of substantial variation among donor countries in their motives for allocating a fixed aid budget across recipient countries (e.g. Alesina & Dollar, 2000; McGillivray, 1989).

This concern about the ability to pool data does not rely solely on a theoretical basis, but is also rooted in statistical considerations. Pesaran and Smith (1995) have in fact shown

[14] This procedure was first described by Parks (1967) and popularized later by Kmenta (1986). Thus, it is usually known either as the Parks or as the Parks–Kmenta estimator. The FGLS method corrects for the cross-sectional problems of spatial correlation and heteroscedasticity and requires that T<N.

that incorrectly pooling data may lead to inconsistent estimates if the model is dynamic. Therefore, we explore empirically the stability of our parameter estimates in two ways:

- First, we exclude each country in our sample one by one and estimate the baseline regression in order to test whether or not the results depend on the set of countries included.
- Second, we choose to split our sample into two major groups (acknowledging that any splitting of the sample into subgroups remains somewhat arbitrary) and estimate the baseline model over the whole period (1970–2007). This allows us to check whether the magnitudes of the coefficients of interest are different from those obtained in the baseline regression over the full sample. The groups are then: European (EU) countries composed of 14 countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom); and non-European (non-EU) countries, composed of 4 countries, namely Australia, Canada, Japan, New Zealand and the United States.

5.2.2 The econometric technique used for robustness check

Beside the estimators described above (PCSE versus FGLS), the econometric literature also proposes (for panels with dimensions like ours), the fixed effects estimator where standard errors are computed using the Driscoll–Kraay (1998) method (henceforth referred to as FE-DK). The Driscoll–Kraay standard error estimates are heteroscedasticity consistent and robust to all general forms of spatial and temporal dependence in the residuals.

In addition, one might also think that because the one or two years lagged dependent variable(s) can be included in the model, depending on Maddala's (1987) test, we could also use the generalized method of moments (GMM) estimator or the LSDVC (least square dummy variables corrected) as an alternative to the LSDV technique (with the PCSE method or the Driscoll–Kraay correction) to establish the robustness of our baseline model's results. However, these two estimators cannot be used here for the following reasons:

- On the one hand, the GMM estimator's properties hold only when the cross-sectional dimension (N) is sufficiently high; in other words, these properties hold when the time period (T) is lower than the cross-sectional dimension (N), that is, N>T (see Arellano & Bond, 1991; Judson & Owen, 1999; Kiviet, 1995), because the estimator may be severely biased and imprecise when the cross-sectional dimension (N) is low

(this is the case in our study). Attanasio et al (2000) study the links between savings, growth and investment on panels with a cross-sectional range of 38 to 123 countries and a time dimension range of 24 to 34 years and explore the appropriateness of different estimation techniques. They argue that with such data dimensions, one should employ estimation techniques that make use of T asymptotics, rather than using estimators that have been developed for micro panels exploiting N asymptotics. They perform both OLS and GMM regressions for the different data sets and observe that GMM estimates are less precise. Consequently, they conclude that when T is sufficiently large, the bias that comes with an OLS estimator of a dynamic model is preferred to the loss of precision that follows the implementation of an instrumental-variable procedure (Attanasio et al, 2000: p.200). This conclusion confirms our choice to use fixed effects techniques to perform our estimations.

- On the other hand, Kiviet (1995, 1999), Judson and Owen (1999) and Bun and Kiviet (2003) have shown that the estimation of dynamic models with panel data is possible on small samples through the use of the LSDVC (corrected least squares dummy variable). Indeed, Judson and Owen (1999),[15] following the work of Kiviet (1995), find that even with T = 30, the LSDV estimator displays a bias of 3–20%. Relying on Monte Carlo simulations, as well as on the root mean square (RMSE) and bias criterion, they conclude that LSDVC, also called the bias-corrected LSDV estimator, consistently outperforms other techniques such as GMM or LSDV. Moreover, Bun and Kiviet (2003) also use Monte Carlo simulations and balanced panels to confirm previous findings according to which the bias-corrected LSDV estimator is more efficient than the LSDV and the first-differenced GMM in terms of bias and root mean square error (RMSE) for small or moderate large samples. Bruno (2005b) relies upon previous Monte Carlo studies to introduce a bias-corrected LSDV for unbalanced panels. He also concludes that the LSDVC estimator outperforms other estimators for samples with a comparatively small cross section. However, the

[15] Note, however, that these authors use Monte Carlo simulations as well as the root mean square (RMSE) and bias criterion and they compare different GMM estimators and the LSDVC technique. First, they observe evidence that the one-step GMM estimator outperforms the two-step GMM estimator and that a 'restricted GMM procedure' does not significantly hamper the performance of the GMM estimation (Judson & Owen 1999: p.13). Moreover, for unbalanced panel data (as is our case), Bruno (2005b) provides strong evidence that favours the use of the LSDVC estimator over the IV/GMM methods for samples constructed as part of his Monte Carlo study ($N, \overline{T}$) = (20, 20) and ($N, \overline{T}$) = (10, 40).

drawback of the LSDVC estimator is that it relies on all regressors being exogenous, not even weakly exogenous.

For all the reasons highlighted above, we primarily use the FE-DK[16] technique for the robustness check of our baseline model's results. It should be noted that for these two econometric techniques (LSDV together with PCSE and FE-DK), if Maddala's (1987) test reveals the presence of 'state dependence' in the dynamic specification, that is, the model is 'state-dependent' with the two lagged dependent variables (as we include two lagged dependent variables at most in our model) or with only one of the lagged dependent variables, then we apply the LSDV together with the PCSE technique (the presence of the lagged dependent variable also corrects partially for serial correlation in the model due to the high time dimension of our panel by including lagged error terms in the specification). In contrast, if the model is 'serially correlated' with the two-year lagged values of the dependent variable according to Maddala's (1987) test, then we remove the lagged dependent variables from the model, correct the serial correlation using the Prais–Winsten estimator and perform the regression using only the LSDV along with the PCSE (to correct only the contemporaneous correlation of error).

To sum up, we estimate our baseline model parameters using the LSDV estimator and we correct the standard errors[17] using the PCSE method in order to take into account both the contemporaneous correlation and heteroscedasticity of the errors. For the robustness check, we employ fixed effects with standard errors computed using the Driscoll–Kraay (1998) method (FE-DK). Maddala's (1987) test, as explained above, is important in determining whether the model is a 'genuine' dynamic specification or if it is an 'error dynamic' specification.

6. Evaluation of the estimation results

In this section, we turn to the interpretation of the results stemming from performing our regressions (Tables 8 to 12) using the LSDV estimator along with the PCSE procedure (and/or the Prais–Winsten estimators) as well as the FE-DK technique.

We perform tests for autocorrelation, homoscedasticity and the independence of residuals between individuals where the null hypotheses are respectively the absence of

[16] The results are obtained using the Stata module « xtscc » implemented by Hoechle (2007).
[17] Although the presence of the lagged dependent variables can address the serial correlation of errors, it does not take into account the contemporaneous correlation of errors.

autocorrelation AR (1) of disturbances, the homoscedasticity of disturbances and the absence of contemporaneous correlation of the residuals. The results of the tests[18] reject all these null hypotheses. It is worth mentioning that the presence of significant residual correlation may be caused by specification error. Hence, following our discussions of the appropriate estimator in section 4.1, we rely mainly on the use of the LSDV with PCSE to perform our estimations. We also present the results stemming from the robustness check of results over the full sample by using the FE-DK (1998) method.[19] The FE-DK estimates are heteroscedasticity consistent and robust to all general forms of spatial and temporal dependence in the residuals. In this chapter, we also use the FE-DK technique to test the robustness of our baseline model's results.

Before the interpretation of the results, let us say few words about the data generating process underlying our different specifications according to Maddala's (1987) test:

- The model for the full sample of 19 countries and that for the sub-sample of EU countries display 'state dependence' with both one- and two-year lagged values of either the ODAGross, ODANet, or NAT dependent variables.
- The model for the sub-sample of non-EU countries is 'state-dependent' only with one-year lagged values of ODAGross and ODANet variables. However, with the NAT dependent variable, it is 'error dynamic' with both one- and two-year lagged values. Since Maddala's (1987) test reveals that in general aid flows exhibit state dependence, we opt to estimate the model for the NAT variable with one-year lagged values of NAT. This helps us interpret the results with greater ease. In addition, the results obtained do not change when we estimate the model with/or without both one- and two-year lagged values of NAT (as suggested by Maddala, 1987).

The results are presented in Table 7.

Table 8 reports alternative estimates of our model (for the full sample of 19 OECD DAC countries over the period 1970–2007) obtained by changing the variables included in the vector $X_{i,t}$ of regressors and/or by using the other measures of aid flows mentioned above. As already discussed, we also check the sensitivity of our coefficients of interest to the inclusion of additional regressors. The results of the coefficients of interest remain roughly stable and robust to the inclusion of these additional variables.

[18] These results are available upon request.
[19] The results are obtained by using the Stata module « xtscc » implemented by Hoechle (2007).

Table 9 presents the results of the baseline model in which each of the sample countries are excluded once from the sample. Table 10 presents the results obtained from the use of FE-DK method. Tables 11 and 12 contain respectively the results for the sub-samples of EU and non-EU countries over the period 1970–2007.

We do not discuss the results of each model specification one by one, but rather provide an overview of the regressors' parameters by assessing whether they are robust and consistent with the expectations presented in sub-section 4.2. We focus particularly on our variables of interest ('episodes of fiscal consolidation', 'episodes of fiscal expansion', 'number of fiscal consolidation episodes', and 'number of fiscal stimulus episodes').

Table 7: Maddala (1987) test for "Aid" variables on the baseline equation.

	Test for $ODAGross_{t-1}$		Test for $ODAGross_{t-2}$		Test for $ODANet_{t-1}$		Test for $ODANet_{t-2}$		Test for NAT_{t-1}		Test for NAT_{t-2}	
	On the restriction of Coefficients	*On the coefficient of* $ODAGross_{t-1}$	*On the restriction of Coefficients*	*On the coefficient of* $ODAGross_{t-2}$	*On the restriction of Coefficients*	*On the coefficient of* $ODANet_{t-1}$	*On the restriction of Coefficients*	*On the coefficient of* $ODANet_{t-2}$	*On the restriction of Coefficients*	*On the coefficient of* NAT_{t-1}	*On the restriction of Coefficients*	*On the coefficient of* NAT_{t-2}
Full Sample	6.25 (0.0001)	212.14 (0.0000)	4.46 (0.0005)	19.75 (0.0000)	5.99 (0.0000)	208.76 (0.0000)	2.87 (0.0143)	27.50 (0.0000)	6.92 (0.0000)	180.70 (0.0000)	2.18 (0.0546)	52.58 (0.0000)
EU Sub-Sample	5.81 (0.0000)	159.97 (0.0000)	3.94 (0.0017)	13.79 (0.0002)	5.50 (0.0001)	156.80 (0.0000)	2.56 (0.0269)	20.65 (0.0000)	6.67 (0.0000)	137.11 (0.0000)	2.04 (0.0725)	40.56 (0.0000)
Non EU Sub-Sample	2.76 (0.0210)	45.85 (0.0000)	0.74 (0.5959)	9.94 (0.0020)	2.43 (0.0382)	44.19 (0.0000)	0.54 (0.7477)	9.98 (0.0020)	1.23 (0.3008)	30.74 (0.0000)	0.18 (0.9692)	12.64 (0.0005)

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01.
: the table contains F-Statistics and the P-Value associated.

Table 8: Effects of Fiscal Episodes in OECD DAC Countries on aid disbursements, 1970-2007

	1[a]	2[a]	3[a]	9[a]	10[a]	11[a]
	ODAGross	**ODANet**	**NAT**	**ODAGross**	**ODANet**	**NAT**
Estimator	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs
Regressors						
Aid_{t-1}	0.588***	0.592***	0.539***	0.592***	0.594***	0.54***
	(0.060)	(0.065)	(0.041)	(0.061)	(0.065)	(0.041)
Aid_{t-2}	0.209***	0.228***	0.287***	0.21***	0.227***	0.287***
	(0.058)	(0.063)	(0.040)	(0.058)	(0.063)	(0.04)
Consolidation	-0.0145**	-0.0145**	-0.016***			
	(0.0072)	(0.007)	(0.0048)			
Stimuli	-0.0016	0.0035	0.0125**			
	(0.0077)	(0.0076)	(0.006)			
NumberConsolidation				-0.033***	-0.020*	-0.010
				(0.011)	(0.011)	(0.008)
NumberConsolidationsq				0.0128***	0.006	-0.0005
				(0.0044)	(0.004)	(0.0038)
NumberStimuli				0.0039	0.015	0.034***
				(0.0136)	(0.013)	(0.011)
NumberStimulisq				-0.0038	-0.008	-0.016***
				(0.0064)	(0.006)	(0.005)
Fiscal_Balance	0.0001	0.0001	-2.67e-05	-0.0001	-4.32e-05	-0.0001
	(0.0009)	(0.0009)	(0.000698)	(0.0009)	(0.000924)	(0.0007)
Debt	-5.75e-05	-0.0002	-0.00026***	-7.78e-05	-0.0002*	-0.00026***
	(0.000120)	(0.0002)	(9.54e-05)	(0.0001)	(0.0001)	(9.43e-05)
Outputgap	0.0036**	0.0027*	0.0028***	0.003**	0.0025*	0.0028***
	(0.0015)	(0.0014)	(0.0009)	(0.0015)	(0.0015)	(0.0009)
Constant	0.016	0.015	0.015	0.017	0.0997***	0.098***
	(0.018)	(0.019)	(0.011)	(0.017)	(0.0192)	(0.011)
Countries - Observations	19-601	19-606	19-606	19-601	19-606	19-606
Overall R^2	0.96	0.96	0.96	0.96	0.96	0.96
Time and or Year Dummies Significance	YES	YES	YES	YES	YES	YES

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01. a: The model is "state-dependent" with one and two year lagged values of the dependent variable. b: The model is "state-dependent" only with one year lagged values of the dependent variable. c: The model is "state-dependent" only with two year lagged values of the dependent variable. d: The model is "error dynamic" (that is the presence of one or two year lagged values of the dependent variable corrects only for serial correlation). The variable "Aid" denotes either ODAGross, ODANet or NAT.

Table 8: Effects of Fiscal Episodes in OECD DAC Countries on aid disbursements, 1970-2007 (continued)

	1[a]	2[a]	3[a]	4[a]	5[a]	6[a]	7[a]	8[a]	9[a]	10[a]	11[a]	12[a]	13[a]
	ODANet	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**	**ODANet**
Estimator	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs	LSDV with PCSEs
Regressors													
Aid_{t-1}	0.555***	0.581***	0.592***	0.593***	0.576***	0.589***	0.591***	0.591***	0.555***	0.588***	0.606***	0.589***	0.624***
	(0.0836)	(0.0643)	(0.0645)	(0.0642)	(0.0647)	(0.0645)	(0.0643)	(0.0643)	(0.0764)	(0.0652)	(0.0510)	(0.0640)	(0.0576)
Aid_{t-2}	0.174**	0.217***	0.228***	0.229***	0.222***	0.226***	0.227***	0.226***	0.204***	0.232***	0.201***	0.231***	0.183***
	(0.0825)	(0.0632)	(0.0630)	(0.0628)	(0.0625)	(0.0627)	(0.0633)	(0.0629)	(0.0744)	(0.0641)	(0.0485)	(0.0626)	(0.0558)
Consolidation	-0.0119	-0.0141**	-0.0145**	-0.0144**	-0.0132*	-0.0141**	-0.0146**	-0.0148**	-0.0126	-0.00930	-0.0162***	-0.0133	-0.0150**
	(0.00819)	(0.00708)	(0.00712)	(0.00709)	(0.00706)	(0.00712)	(0.00712)	(0.00708)	(0.00771)	(0.00839)	(0.00593)	(0.00935)	(0.00618)
Stimuli	0.00922	0.00451	0.00345	0.00341	0.000902	0.00386	0.00353	0.00369	0.00230	0.00347	0.00618	-0.000172	-0.000160
	(0.00948)	(0.00750)	(0.00756)	(0.00745)	(0.00745)	(0.00753)	(0.00757)	(0.00754)	(0.00853)	(0.00745)	(0.00733)	(0.0102)	(0.00729)
Fiscal_Balance	-0.00149	-0.000105	0.000107	-0.000246	-0.000309	5.43e-05	2.90e-05	0.000144	-0.00130	6.17e-05	0.000211	0.000176	-0.000357
	(0.00123)	(0.000919)	(0.000911)	(0.000902)	(0.000918)	(0.000917)	(0.000940)	(0.000912)	(0.00108)	(0.000909)	(0.000920)	(0.000942)	(0.000885)
Debt	-0.000391**	-0.000280**	-0.000189	-0.000194	-0.000245**	-0.000194	-0.000181	-0.000186	-0.000356**	-0.000189	-0.000246**	-0.000199*	-0.000160
	(0.000161)	(0.000125)	(0.000118)	(0.000120)	(0.000122)	(0.000119)	(0.000118)	(0.000118)	(0.000148)	(0.000119)	(0.000108)	(0.000119)	(0.000123)
Outputgap	0.00377**	0.00294**	0.00266*	0.00229	0.00268*	0.00278*	0.00271*	0.00263*	0.00153	0.00260*	0.00140	0.00259*	0.00213
	(0.00178)	(0.00142)	(0.00143)	(0.00143)	(0.00138)	(0.00148)	(0.00144)	(0.00142)	(0.00184)	(0.00141)	(0.00130)	(0.00145)	(0.00141)
icrg_qog	0.116												
	(0.0735)												
Lpop		-0.147**											
		(0.0593)											
Cold			-0.0365**										
			(0.0153)										
bankingcrises				-0.0185*									
				(0.0112)									
Reer					0.000792***								
					(0.000205)								
Inflation						-0.000965							
						(0.00129)							
Trade							0.000144						
							(0.000297)						
Political Orientation								-0.00240					

								(0.00285)					
Unemployment									-0.00261**				
									(0.00130)				
Yearbeforeelec										0.00211			
										(0.00524)			
YbelecConsolidation										-0.0177			
										(0.0147)			
Welfareinst											0.00346***		
											(0.00132)		
Devagency												0.00501	
												(0.00882)	
Devagency-Consolidation												-0.00384	
												(0.0143)	
Devagency-Stimuli												0.00768	
												(0.0150)	
AgreeUN													-0.00806
													(0.0430)
Constant	-0.0143	2.452**	0.0513***	0.0143	-0.0579**	0.117***	0.0123	0.108***	0.0571***	0.0129	0.0466*	0.0110	0.112***
	(0.0714)	(0.984)	(0.0120)	(0.0190)	(0.0280)	(0.0258)	(0.0197)	(0.0208)	(0.0194)	(0.0199)	(0.0246)	(0.0199)	(0.0366)
Countries-Observations	19-445	19-606	19-606	19-606	19-606	19-606	19-606	19-606	19-497	19-606	17-464	19-606	19-606
Overall R^2	0.964	0.960	0.960	0.960	0.961	0.960	0.960	0.960	0.963	0.960	0.967	0.960	0.964
Country/ Year Dummies Significance	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01.
a: The model is "state-dependent" with one and two year lagged values of the dependent variable. b: The model is "state-dependent" only with one year lagged values of the dependent variable.
c: The model is "state-dependent" only with two year lagged values of the dependent variable. d: The model is "error dynamic" (that is the presence of one or two year lagged values of the dependent variable corrects only for serial correlation).
The variable "Aid" denotes either ODAGross, ODANet or NAT.

Table 9: Effects of fiscal episodes variables on Aid Supplies if countries are excluded (Using LSDV and PCSE)

Country Excluded	Effect of Fiscal Episodes on ODAGross		Effect of Fiscal Episodes on ODANet		Effect of Fiscal Episodes on NAT	
	Fiscal consolidation	Fiscal Expansion	Fiscal consolidation	Fiscal Expansion	Fiscal consolidation	Fiscal Expansion
Australia	-0.0141*	0.000510	-0.0143**	0.00536	-0.0157***	0.0149**
	(0.00733)	(0.00807)	(0.00723)	(0.00792)	(0.00488)	(0.00622)
Austria	-0.0194***	-0.000954	-0.0197***	0.00398	-0.0179***	0.0123**
	(0.00701)	(0.00785)	(0.00691)	(0.00767)	(0.00497)	(0.00605)
Belgium	-0.0167**	-0.00367	-0.0164**	0.00185	-0.0179***	0.0117*
	(0.00746)	(0.00813)	(0.00734)	(0.00795)	(0.00503)	(0.00621)
Canada	-0.0150**	0.000811	-0.0148**	0.00499	-0.0162***	0.0132**
	(0.00756)	(0.00797)	(0.00751)	(0.00788)	(0.00500)	(0.00621)
Denmark	-0.0146*	0.00107	-0.0123*	0.00518	-0.0121**	0.0142**
	(0.00748)	(0.00778)	(0.00735)	(0.00764)	(0.00483)	(0.00583)
Finland	-0.0144*	-0.00429	-0.0153**	0.000820	-0.0172***	0.0103
	(0.00746)	(0.00817)	(0.00741)	(0.00809)	(0.00492)	(0.00640)
France	-0.0158**	-0.00620	-0.0151**	0.000498	-0.0169***	0.0122*
	(0.00734)	(0.00803)	(0.00725)	(0.00788)	(0.00488)	(0.00627)
Germany	-0.0151**	-0.00150	-0.0150**	0.00370	-0.0163***	0.0127*
	(0.00694)	(0.00767)	(0.00681)	(0.00748)	(0.00545)	(0.00653)
Ireland	-0.0140*	-0.00409	-0.0134*	0.00157	-0.0145***	0.0113*
	(0.00752)	(0.00801)	(0.00743)	(0.00787)	(0.00490)	(0.00611)
Italy	-0.0133*	0.00237	-0.0138*	0.00693	-0.0164***	0.0159**
	(0.00793)	(0.00790)	(0.00782)	(0.00775)	(0.00517)	(0.00622)
Japan	-0.0160**	-0.00289	-0.0161**	0.00332	-0.0178***	0.0142**
	(0.00750)	(0.00819)	(0.00739)	(0.00813)	(0.00485)	(0.00598)
Netherlands	-0.0108	-0.00338	-0.0104	0.00268	-0.0112**	0.0131**
	(0.00772)	(0.00817)	(0.00772)	(0.00792)	(0.00509)	(0.00615)
New Zealand	-0.0148*	-0.00116	-0.0148**	0.00405	-0.0163***	0.0135**
	(0.00760)	(0.00782)	(0.00749)	(0.00768)	(0.00510)	(0.00610)
Norway	-0.0141*	-0.00638	-0.0141*	-0.00115	-0.0168***	0.00877
	(0.00756)	(0.00812)	(0.00752)	(0.00799)	(0.00505)	(0.00621)
Portugal	-0.0114*	0.00259	-0.0132**	0.00875	-0.0170***	0.0133**
	(0.00596)	(0.00667)	(0.00596)	(0.00664)	(0.00512)	(0.00630)
Spain	-0.0151**	-0.00101	-0.0151**	0.00395	-0.0165***	0.0132**
	(0.00750)	(0.00791)	(0.00740)	(0.00781)	(0.00501)	(0.00621)

Sweden	-0.0112	-0.00120	-0.0110	-7.46e-05	-0.0129***	0.00377
	(0.00746)	(0.00779)	(0.00734)	(0.00760)	(0.00468)	(0.00556)
United Kingdom	-0.0160**	-0.00127	-0.0162**	0.00419	-0.0181***	0.0148**
	(0.00765)	(0.00824)	(0.00755)	(0.00805)	(0.00506)	(0.00652)
United States	-0.0143**	-0.000300	-0.0145**	0.00400	-0.0162***	0.0128**
	(0.00726)	(0.00788)	(0.00716)	(0.00774)	(0.00482)	(0.00609)

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01.

We recall that ODAGross (the gross aid disbursements) measures the total aid disbursements, ODANet (the net aid disbursements) represents gross aid disbursements minus the repayments of loan principal or recoveries on grants received during the same period, and NAT (the net aid transfers) subtracts not only the repayments of principal from ODAGross, but also interest payments and the cancellation of non-ODA loans (that is, debt relief). The exclusion of debt relief from the definition of aid is justified by the fact that debt cancellation does not give rise to an actual disbursement of funds and may even imply a double counting of aid if the debt that is cancelled was granted on a concessional basis (see also Bertoli et al, 2008). Accordingly, the NAT variable appears to approximate more closely the current budgetary outlays associated with aid (see also Dang et al, 2010).

On the full sample (Table 8), we observe that irrespective of the measure of 'aid variable' used, aid supplies decline during episodes of fiscal consolidation: over the period 1970–2007, one more year of fiscal retrenchment (compared to the years of absence of fiscal adjustments) decreases aid generosity by 0.0145% of GDP for both the ODAGross and ODANet variables and 0.016% of GDP for NAT variable.

In addition, the use of the counter variables described previously leads us to conclude that one more year of fiscal consolidation leads to a fall in ODAGross effort of 0.03% of GDP and an average decline in ODANet effort of 0.02% of GDP (although the significance of the coefficient is at the 10% level). However, no significant effect for the NAT variable is observed. Only the ODAGross exports appear on average to rebound after approximately 1.28 years. The result found for NAT seems to reinforce the hypothesis of Round and Odedokun (2004: p.306) (see sub-section 4.2) according to which aid is not a particular item in the budget that should be cut (even) during fiscal consolidation periods because it acts as an influential foreign policy tool for donor governments. Therefore, given the aforementioned difference in the measurement of the three aid variables, we can conclude here (when we use the counter variables) that during episodes of large fiscal consolidations in traditional OECD donor countries, the real disbursements of funds are not affected (that is, they neither decline nor increase).

Large-scale fiscal stimulus episodes do not affect either the ODAGross effort or the ODANet effort. One more year of fiscal stimulus affects only the NAT variable and leads to a rise in NAT effort of 0.034% of GDP, an effect that seems to decrease after approximately 1.08 years. Thus, we can also conclude here that during large-scale fiscal expansion episodes, donors increase their real disbursements of funds to developing countries.

In agreement with Round and Odedokun (2004) and Boschini and Olofsgard (2007), but in contrast to Bertoli et al (2008), Faini (2006) and Mosley (1985), the parameter of the fiscal surplus in percentage of GDP is not statistically significant for all specifications. This suggests that, all other things being equal, the fiscal balance does not exert a significant long-run average effect on the level of foreign aid.

The coefficient on public debt exhibits alternating significant and non-significant negative effects on aid supplies. The output gap appears always to exert a positive significant effect on aid supplies.

What then about the results of the exclusion of countries (Table 9)? The results regarding the ODAGross and the ODANet dependent variables suggest evidence that during the years of large-scale fiscal stimulus episodes, the aid expenditure of traditional OECD donors neither increases nor decreases. However, the NAT variable appears to be affected positively and significantly during large-scale fiscal expansion years: the results are suggestive of the fact that when we exclude either Finland, Norway or Sweden from the full sample of countries, the effect of the 'large fiscal expansion variable' on the NAT variable exhibits alternating positive and negative signs, but is never statistically significant. This may mean that these three countries play a key role in the rise of aid (NAT) from OECD countries during large-scale fiscal stimulus episodes.

With respect to the effect of large fiscal consolidation measures on the aid supply of OECD countries, we almost always obtain a negative and significant effect. For the ODAGross variable, the effect is negative and significant when we exclude each country once from the full sample of 19 OECD countries, except for the case of the exclusion of Sweden. For the ODANet variable, we observe the same negative and significant effect except for the exclusion of Sweden and of the Netherlands. For the NAT variable, the negative effect is obtained irrespective of the country that is excluded from the full sample; moreover, this effect is always significant at the 1% level. Overall, the results seem to confirm those obtained over the whole sample of OECD countries.

The robustness check of our baseline model's results (see Table 10) using the FE-DK technique suggests roughly the same results as in Table 8 (although with different standard errors), except for the case of the ODANet variable where:

- the aid effort declines by 0.02% of GDP for one more year of fiscal retrenchment and rebounds after approximately 1.8 years;

- an additional year of fiscal stimulus seems to exert on average a permanent negative effect on aid effort.

Table 10: **Effects of Fiscal Episodes in OECD DAC Countries on aid disbursements, 1970-2007, using Daniel Hoechle's technique: Fixed-effects regression with Driscoll and Kraay standard errors (FEDK).**

	1[a]	2[a]	3[a]	4[a]	5[a]	6[a]
	ODAGross	**ODANet**	**NAT**	**ODAGross**	**ODANet**	**NAT**
Estimator	FEDK	FEDK	FEDK	FEDK	FEDK	FEDK
Regressors						
Aid_{t-1}	0.588***	0.592***	0.539***	0.592***	0.594***	0.54***
	(0.059)	(0.062)	(0.081)	(0.060)	(0.064)	(0.08)
Aid_{t-2}	0.209***	0.228***	0.287***	0.21***	0.227***	0.287***
	(0.05)	(0.054)	(0.088)	(0.052)	(0.055)	(0.088)
Consolidation	-0.0145***	-0.0145***	-0.016**			
	(0.00434)	(0.00440)	(0.00603)			
Stimuli	-0.0016	0.003	0.013			
	(0.01)	(0.008)	(0.009)			
NumberConsolidation				-0.033***	-0.02***	-0.01
				(0.007)	(0.006)	(0.008)
NumberConsolidationsq				0.013***	0.0057**	-0.0005
				(0.003)	(0.0022)	(0.0047)
NumberStimuli				0.004	0.0153	0.034**
				(0.012)	(0.0125)	(0.013)
NumberStimulisq				-0.004	-0.008*	-0.016***
				(0.005)	(0.005)	(0.005)
Fiscal_Balance	0.0001	0.0001	-2.67e-05	-0.0001	-4.32e-05	-0.0001
	(0.0009)	(0.0008)	(0.0007)	(0.0009)	(0.0008)	(0.0007)
Debt	-5.75e-05	-0.00019	-0.00026**	-7.78e-05	-0.0002	-0.00026**
	(0.0001)	(0.00012)	(0.00011)	(0.0001)	(0.0001)	(0.00012)
Outputgap	0.0036**	0.003**	0.00276**	0.003**	0.0025*	0.0028**
	(0.0017)	(0.001)	(0.0012)	(0.001)	(0.0013)	(0.0013)
Constant	0.047***	0.0442***	0.043***	0.049***	0.048***	0.048***
	(0.013)	(0.0126)	(0.011)	(0.013)	(0.013)	(0.011)
Countries - Observations	19-601	19-606	19-606	19-601	19-606	19-606
Within R^2	0.69	0.71	0.72	0.69	0.71	0.72
Time and Year Dummies	YES	YES	YES	YES	YES	YES

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01. a: The model is "state-dependent" with one and two year lagged values of the dependent variable. b: The model is "state-dependent" only with one year lagged values of the dependent variable. c: The model is "state-dependent" only with two year lagged values of the dependent variable. d: The model is "error dynamic" (that is the presence of one or two year lagged values of the dependent variable corrects only for serial correlation).
The variable "Aid" denotes either ODAGross, ODANet or NAT.

Turning to our sub-samples of countries, we observe that the results of the baseline model reported in Table 11 for the EU countries are broadly in line with those found previously for the full sample (Table 8), suggesting that EU countries exhibit on average the same behaviour in terms of aid supply as those observed for the full sample.

Table 11: Effects of Fiscal Episodes in European Union DAC Countries on aid disbursements, 1970-2007

	1[a]	**2[a]**	**3[a]**	**4[a]**	**5[a]**	**6[a]**
	ODAGross	**ODANet**	**NAT**	**ODAGross**	**ODANet**	**NAT**
Estimators	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**
Variables						
Aid_{t-1}	0.631***	0.622***	0.591***	0.637***	0.626***	0.592***
	(0.0652)	(0.0677)	(0.0461)	(0.0653)	(0.0681)	(0.0465)
Aid_{t-2}	0.137**	0.171**	0.219***	0.132**	0.168**	0.219***
	(0.0635)	(0.0665)	(0.0446)	(0.0634)	(0.0669)	(0.0448)
Consolidation	-0.0176**	-0.0177**	-0.0193***			
	(0.00794)	(0.00764)	(0.00513)			
Stimuli	0.00360	0.00668	0.0131**			
	(0.00869)	(0.00867)	(0.00647)			
NumberConsolidation				-0.0399***	-0.0246**	-0.0112
				(0.0118)	(0.0113)	(0.00893)
NumberConsolidationsq				0.0153***	0.00650	-0.00125
				(0.00442)	(0.00442)	(0.00412)
NumberStimuli				0.00937	0.0194	0.0379***
				(0.0146)	(0.0146)	(0.0115)
NumberStimulisq				-0.00400	-0.00875	-0.0167***
				(0.00628)	(0.00626)	(0.00520)
Fiscal_Balance	0.000247	0.000318	0.000272	9.68e-05	0.000249	0.000222
	(0.00102)	(0.00109)	(0.000780)	(0.00103)	(0.00108)	(0.000783)
Debt	-0.000207	-0.000299*	-0.000377***	-0.000219	-0.000291*	-0.000348***
	(0.000173)	(0.000173)	(0.000129)	(0.000174)	(0.000174)	(0.000130)
Outputgap	0.00503**	0.00373*	0.00353***	0.00461**	0.00357*	0.00371***
	(0.00201)	(0.00197)	(0.00109)	(0.00204)	(0.00200)	(0.00112)
Constant	0.115***	0.104***	0.0955***	0.204***	0.0816***	0.0926***
	(0.0250)	(0.0262)	(0.0164)	(0.0379)	(0.0257)	(0.0164)
Countries-Observations	14-435	14-440	14-440	14-435	14-440	14-440
Overall R^2	0.96	0.96	0.98	0.96	0.96	0.98
Time and or Year Dummies	YES	YES	YES	YES	YES	YES

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01.
a: The model is "state-dependent" with one and two year lagged values of the dependent variable. b: The model is "state-dependent" only with one year lagged values of the dependent variable. c: The model is "state-dependent" only with two year lagged values of the dependent variable. d: The model is "error dynamic" (that is the presence of one or two year lagged values of the dependent variable corrects only for serial correlation).
The variable "Aid" denotes either ODAGross, ODANet or NAT.

In terms of the non-EU donor countries, the results reported in Table 12 show evidence that this sub-group of countries behaves differently compared to EU countries in several ways. The fiscal retrenchment episodes do not affect the aid efforts of these countries at all (the long-run average value of fiscal consolidation episode coefficients are not statistically

significant, even at the 10% level), irrespective of the aid variable considered. Hence, the real disbursements of funds by these donors are not affected when they experience fiscal retrenchment episodes. However, concerning the fiscal stimulus variables, we observe that one more year of fiscal stimulus leads to a decline in aid effort (the latter result applies only to ODAGross and ODANet variables but not to NAT variable) without any expected rebound effect after a certain period. Hence, the results based on ODAGross and ODANet variables suggest that during large-scale fiscal expansion periods, donors cut aid expenditure to developing countries at the benefit of other expenditure components. Donors' real aid expenditure to developing countries does not appear to be affected during the large-scale fiscal expansion periods (in donors' economies). When considering the counter variables (the number of years since the start of fiscal consolidation in a donor country as well as its squares and the number of years since the start of fiscal stimulus in a donor country as well as its squares), we observe roughly the same results as those obtained for the variables of fiscal consolidation and fiscal stimulus episodes. These results lead us to conclude that despite the wealth and the lead of these countries in the renewal of aid commitments, episodes of fiscal stimulus could hit their aid supplies severely. Furthermore, in contrast with the EU sub-sample (and the full sample), we find evidence that an improvement in fiscal balance leads to a reduction in aid effort irrespective of the aid variable considered and a higher debt accumulation induces a rise in ODAGross effort, the effect on the other aid variables appearing statistically insignificant. The output gap does not influence the aid exports of this sub-group of countries.

Overall, for the full sample, we obtain evidence that during fiscal consolidation episodes, the traditional OECD donors reduce their aid expenditure. The effect of large-scale fiscal stimulus episodes on the donors' aid generosity seems to depend on the aid variable considered, although given the definition of the NAT variable, we can conclude that the donors increase the real disbursements of funds to developing countries during such episodes. Whereas the EU countries appear to exhibit on average the same behaviour in terms of their aid supply as the full sample, on average the non-EU countries behave differently.

Table 12: Effects of Fiscal Episodes in Non EU Countries on aid disbursements, 1970-2007

	1[b]	2[b]	3[d]	4[b]	5[b]	6[d]
	ODAGross	**ODANet**	**NAT**	**ODAGross**	**ODANet**	**NAT**
Estimators	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**	**LSDV with PCSEs**
Regressors						
Aid_{t-1}	0.566***	0.606***	0.595***	0.566***	0.605***	0.585***
	(0.0604)	(0.0607)	(0.0696)	(0.0603)	(0.0598)	(0.0682)
Consolidation	0.000591	0.00122	0.000274			
	(0.00836)	(0.00726)	(0.00782)			
Stimuli	-0.0326***	-0.0225**	-0.0145			
	(0.0102)	(0.00902)	(0.0104)			
NumberConsolidation				-0.0135	-0.0130	-0.0172
				(0.0150)	(0.0125)	(0.0141)
NumberConsolidationsq				0.00937	0.00920*	0.0111*
				(0.00725)	(0.00548)	(0.00672)
NumberStimuli				-0.0557**	-0.0479**	-0.0364
				(0.0266)	(0.0236)	(0.0250)
NumberStimulisq				0.0185	0.0196	0.0155
				(0.0187)	(0.0172)	(0.0166)
Fiscal_Balance	-0.00478***	-	-0.00471***	-0.00506***	-0.00479***	-0.00528***
	(0.00139)	(0.00127)	(0.00145)	(0.00141)	(0.00130)	(0.00146)
Debt	0.000388**	7.41e-05	-0.000107	0.000373**	6.38e-05	-0.000126
	(0.000162)	(0.000141)	(0.000151)	(0.000162)	(0.000141)	(0.000149)
Outputgap	0.00303	0.00242	0.00255	0.00310	0.00261	0.00298
	(0.00203)	(0.00188)	(0.00206)	(0.00204)	(0.00189)	(0.00205)
Constant	0.152***	0.142***	0.148***	0.122***	0.141***	0.122***
	(0.0252)	(0.0251)	(0.0294)	(0.0259)	(0.0249)	(0.0295)
Countries-Observations	5-170	5-170	5-170	5-170	5-170	5-170
Overall R^2	0.95	0.96	0.97	0.95	0.96	0.97
Time and/or Year Dummies	YES	YES	YES	YES	YES	YES

Note: Standard deviations are in parenthesis - *p-value<0,1; **p-value<0,05; ***p-value<0,01. a: The model is "state-dependent" with one and two year lagged values of the dependent variable. b: The model is "state-dependent" only with one year lagged values of the dependent variable. c: The model is "state-dependent" only with two year lagged values of the dependent variable. d: The model is "error dynamic" (that is the presence of one or two year lagged values of the dependent variable corrects only for serial correlation).
The variable "Aid" denotes either ODAGross, ODANet or NAT.

7. Conclusion and Policy Implications

In this chapter, we analyze the behavior of OECD donor countries with respect to their aid effort during the fiscal episodes (episodes of fiscal consolidation and episodes of fiscal stimuli). The focus here is on a panel of 19 OECD DAC countries over the period 1970–2007 where we employ three different variables to capture aid effort. To perform this analysis, we use descriptive statistics provided by Alesina and Ardagna (2010) on fiscal episodes in OECD countries and regression models. In the latter, we control for several other macroeconomic, political, institutional and international political economy variables in addition to our core variables (fiscal episodes).

Several results emerge:

- Considering our full sample of OECD DAC countries, we observe that fiscal consolidation episodes reduce aid effort, whatever aid variable considered, with these negative effects sometimes diminishing over time. However, fiscal stimuli episodes exert significant and positive effects only on aid the Net Aid Transfers variable, the other aid variables do not significantly respond to fiscal stimuli periods.

- The effects of fiscal episodes on aid supply depend also on the group of countries under consideration. In fact, when turning to our sub-samples, we observe that European Union countries exhibit the same behaviour in terms of aid effort (with few exceptions) as those of the full sample of countries. In contrast, aid exports of Non-European Countries (Non EU) do not seem to be affected during episodes of large fiscal retrenchment, whereas the effect of their large episodes of loose discretionary fiscal policy on aid expenditure appears to depend on the variable considered, with a severe negative effect on Gross aid flows and Net Aid flows and a statistically nil effect on Net Aid Transfers (that is here the real aid expenditure). In addition these negative effects of loose fiscal policy highlighted do not decrease over time.

The current situation characterized by large public debt overhangs - and strains on public finances - in many OECD countries, as well as the ongoing effects the recent (2008) financial crisis, makes the findings of our study particularly relevant. Based on these results, we can infer that the fiscal adjustment measures being currently adopted by many developed countries, especially the European Union ones will negatively affect their aid expenditures, with these negative effects being likely higher than expected, given the severity of the crises. The figures provided in the Introduction of this Chapter validate our findings. Hence, the curtailments observed will severely affect the investment spending of developing countries,

especially Africans, with deleterious effects on economic growth and poverty reduction. As a result, the attainment of the Millennium Development Goals (MDGs) is likely to be severely jeopardized in these countries.

These results raise the question of whether developing countries (particularly Low-Income countries) should continue in the long-run to be highly dependent on aid flows for financing their spending needs. Indeed, acknowledging the current crucial role of aid inflows for many aid recipients (especially Low-Income Countries) and regarding the dependence of these inflows on the fiscal circumstances in donor countries, we make the following recommendations:

For any country, tax revenues remain unavoidably the main source of financing public expenditures in the perspective of sustainable development in the long term. This is why the International Community should help developing countries strengthen their mobilization of tax revenue by removing the main obstacles to the improvement of such mobilization, including the size of the informal sector.

The International Community decided during the Monterrey Summit in 2002 to find innovative financing mechanisms in order to help developing countries achieve their development purposes. It becomes more urgent to develop and make such mechanisms more operational through for instance the international financial tax transactions and the reduction of remittances costs at the international level.

The International Community should also help developing countries (especially Low-Income Countries) develop and deepen their domestic financial markets in order to allow them to simultaneously rely less on foreign capital flows (that can be very costly compared to domestic financing) and channel the saving towards investments for sustainable development purposes.

Furthermore, we would like to highlight two limits to our study: the first is our focus on only traditional OECD donors which are the main ones in terms of aid supply. However, the so-called “emerging countries” have appeared recently to start playing an important role in terms of aid provision to the other developing countries within the framework of South-South cooperation. It would thus be interesting to explore in another study whether fiscal policy measures in these “emerging countries” matter for their development assistance.

One may also require us to extend our database to the recent year for which fiscal variables are available (2011) (though the fiscal episodes variables come from Alesina and Ardagna, 2010). This is not really a limit of our study because the fiscal austerity measures currently

adopted by many OECD countries especially European Union countries are on-going and will last many years (for example, these measures should be implemented until 2017 for France). Therefore, such extension seems unsuitable.

Appendix and Tables

Appendix 1: Description of variables and Sources

ODAGross = Gross Official Development Assistance disbursed by each donor in percent of GDP. This variable includes ODA to multilateral institutions. Source: Development Assistance Committee (DAC) Databases; OECD (2010).

ODANet = Net Official Development Assistance disbursed by each donor, in percent of GDP. This variable includes ODA to multilateral institutions. Source: Development Assistance Committee (DAC) Databases; OECD (2010).

NAT = Net Aid Transfers disbursed by each donor, as a percentage of GDP. This variable includes transfers to multilateral institutions. Source: Centre for Global Development - Roodman (2008 and 2012).

Consolidation = Episodes of Fiscal Consolidation (Adjustment). This is a dummy variable taking the value 1 the year of large fiscal consolidation, and the value 0, otherwise. Source: Alesina, A., and Ardagna, S. (2010) "Large Changes in Fiscal Policy: Taxes vs Spending," Tax Policy and the Economy , Volume 24, Chapter 2, pp 35–68. For the data, see the Appendix Table A.2 of the chapter.

Stimuli = Episodes of Fiscal Stimuli (Expansion). This is a dummy variable taking the value 1 the year of large fiscal stimuli, and the value 0, otherwise. Source: Alesina, A., and Ardagna, S. (2010) "Large Changes in Fiscal Policy: Taxes vs Spending," Tax Policy and the Economy, Volume 24, Chapter 2, pp 35–68. For the data, see the Appendix Table A.2 of the chapter.

NumberConsolidation = the Number of years since the large fiscal consolidation has started in a donor country, with the first year of the fiscal consolidation taking a value of 1. The other years of lack of large fiscal consolidation measures take the value 0. Source: Calculated by the author using the Episodes of Fiscal Adjustment identified by Ardagna and Alesina (2010).

NumberConsolidationsq = the square of the variable "Number of fiscal consolidation's years". Source: Calculated by the author using the Episodes of Fiscal Adjustment identified by Ardagna and Alesina (2010).

Numberstimuli = the Number of years since the fiscal stimuli has started in a donor country, with the first year of the large fiscal stimuli taking a value of 1. The other years of lack of fiscal stimuli measures take the value 0. Source: Calculated by the author using the Episodes of Fiscal Stimuli identified by Ardagna and Alesina (2010).

Numberstimulisq = the square of the variable "Number of fiscal Stimuli's years". Source: Calculated by the author using the Episodes of Fiscal Stimuli identified by Ardagna and Alesina (2010).

Debt = Gross Public Debt-to-GDP-ratio. Source: The International Monetary Fund (IMF)'s New comprehensive database on Public debt – (November 2010).

Fiscal_Balance = General government fiscal balances (Total Revenues minus Total Expenditures) in percent of GDP. Source: OECD Economic Outlook N° 88 – December 2010.

Output Gap = the difference between the maximum output achievable and the actual level of output. Source: OECD Economic Outlook N° 88 – December 2010.

Lrgdp = Log(Real GDP per capita 2005 constant prices in US Dollars). Source: Pen World Tables (PWT 6.3), 2009.

Icrg_qog = Quality of Governance: The quality of governance is measured by subjective indices from the International Country Risk Guide (ICRG). The quality-of-governance index from ICRG used here is an 18-point scale, created by summing the following three six-point scales: corruption in government, bureaucratic quality, and the rule of law. See the ICRG for the criteria used in coding these measures. The rationale for corruption and bureaucratic quality is obvious. The rule-of-law definition indicates that this measure reflects the government's administrative capacity in enforcing the law, as well as the potential for rent-seeking associated with weak legal systems and insecure property rights. Source: International Country Risk Guide (ICRG) Data.

REER = Real effective exchange rates based on consumer price indices - Year 2005 = 100; An increase denotes a depreciation. Source: OECD Economic Outlook N° 88 – December 2010.

Unemployment = Unemployment Rate (in % of Total Labor Force). Source: OECD Economic Outlook N° 88 – December 2010.

Bankingcrises = Banking Crises – It is a dummy variable that takes the value of 1 during the years of banking crises et 0 otherwise. Data provided by Luc Laeven and Fabian Valencia (June 2010) – Website: http://www.luclaeven.com/Data.htm

Devagency = Independence of aid Agency = The data are provided by Bertoli et al. (20089 and completed by the Author. This variable takes the value "1" if the development aid agency is independent from the state and "0", otherwise. The variable "DevagencyConcolidation" is calculated as Devagency*Consolidation. It captures the behavior of independent development agencies during fiscal consolidation episodes. In addition, the variable "DevagencyStimuli" is calculated as Devagency*Stimuli. It captures the behavior of independent development agencies during fiscal loose episodes.

Inflation = Inflation rate, consumer prices (annual %). Source: OECD Economic Outlook N° 88 – December 2010.

Trade = Openness degree to trade = (Export + Imports)/GDP. Source: OECD Economic Outlook N° 88 – December 2010.

Outputgap = Output Gap = the difference between the maximum output achievable and the actual level of output. Source: OECD Economic Outlook N° 88 – December 2010.

Cold = This is a dummy variable that takes the value "1" for years before or equal to 1990 and "0" after 1990. Source: Author Calculation.

Lpop = Natural logarithm of the level of population. Source: OECD Economic Outlook N° 88 – December 2010.

Elec = Election Year - 1970-2008: The variable "Yearbeforeelec" is a dummy that captures one yearbefore the election. The variable

YbelecConsolidation = Yearbeforeelec*Consolidation - Source: Armingeon et al. (2010) and calculation from the Author - Political Variables
See
http://www.ipw.unibe.ch/content/team/klaus_armingeon/comparative_political_data_sets/index_ger.html

PoliticalOrientation = Political Orientation variable = {0} if there is equality in the combination of two of these three parties (for example 50% of Right Party and 50% of Left Party); {1} if the Right party dominates the government; = {2} if the Centre party dominates the government and {3} if the Left party dominates the government. Source: Constructed by the Author using the Database of Political Institutions available online from the World Bank (Beck et al., 2010).

Welfareinst = the "generosity" measure of welfare state institutions. Source: Database of Scruggs Lyle (2006), http://sp.uconn.edu/scruggs/wp.htm

AgreeUN = The voting similarity index in United Nations General Assembly (UNGA): To construct the variable capturing voting alignment of developing countries to the donors in United Nations General Assembly, we use the UNGA (United Nations General Assembly) voting dataset provided by Voeten and Merdzanovic (2009). More particularly, we use the "voting similarity index (0-1)". The latter is computed using 3 category vote data (1 = "yes" or approval for an issue; 2 = abstain, 3 = "no" or disapproval for an issue). Abstention is counted as half-agreement with a yes or no vote (see the dataset on the website:
http://dvn.iq.harvard.edu/dvn/dv/Voeten/faces/study/StudyPage.xhtml?globalId=hdl:1902.1/12379.
This variable is provided for pair of countries (developed country-developing country) and for each year. To obtain our desired data, we average for each developed country and for each year of our period of study (1970-2007) the values over all developing countries. This allows us to obtain for each developed country and per year, a voting similarity associated to all developing countries (that receive aid from that developed country) and for which the data are available. We call the variable thus obtained "AgreeUN".

Appendix 2: Descriptive Statistics for the full sample of 19 countries

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Odagrossgdp	698	0.425	0.248	0.012	1.06
Odanet	722	0.388	0.249	0	1.04
Nat	722	0.366	0.2445	0	1.03
Consolidation	653	0.152	0.359	0	1
Stimuli	653	0.130	0.337	0	1
NumberConsolidation	653	0.1945	0.52	0	4
NumberConsolidationsq	653	0.308	1.195	0	16
NumberStimuli	653	0.165	0.473	0	3
NumberStimulisq	653	0.251	0.9615	0	9
Fiscal_Balance	690	-2.193	4.33	-16.008	18.48
Debt	712	52.328	29.105	0	191.6
Outputgap	644	-0.134	2.14	-8.72	6.5
icrg_qog	456	0.901	0.099	0.523	1
lpop	722	16.7221	1.262	14.855	19.524
cold	722	0.553	0.498	0	1
bankingcrises	722	0.036	0.186	0	1
Reer	718	97.746	13.269	48.339	144.728
Inflation	700	5.809362	5.103	-9.629	28.783
Trade	722	62.57673	31.462	11.257	184.742
Political_Orientation	722	1.889	0.972	0	3
Unemployment	499	7.642	3.881	1.6	23.9
Yearbeforeelec	722	0.288	0.453	0	1
Welfareinst	542	27.281	7.545	11.035	45.378
Devagency	722	0.363	0.481	0	1
Agreeun	702	0.698	0.1026	0.243	0.871

Appendix 3: Description of Maddala (1987)'s Test

Consider the following model: $y_{i,t} = \beta y_{i,t-1} + \alpha_i + u_{i,t}$ (1). Maddala (1987) suggests that an important issue that arises in dynamic models is that of "serial correlation" versus "state dependence", that is, whether any direct effects of the dependent variable exist apart from those generate indirectly by the serial correlation of the errors. Alternative terminology for the "serial correlation model" versus "state-dependence model" is model with "error dynamics" and "system dynamics", respectively. To clarify this problem, consider a single cross-section unit where we drop the subscript I (this issue is not special to panel data and concerns also the usual regression models as well). For example, consider the regression model with no lagged variables, but serially correlated errors: $\begin{cases} y_t = \beta x_t + u_t \\ u_t = \rho x_{t-1} + e_t \end{cases}$

We can write it as $y_t = \beta y_{t-1} + \beta x_t - \rho\beta x_{t-1} + e_t$ (2). The model in (2) is the same as the dynamic regression equation: (3) $y_t = \gamma y_{t-1} + \beta_0 x_t - \rho\beta x_{t-1} + e_t$ with the restriction $\gamma\beta_0 + \beta_1 = 0$. The two models thus differ in this restriction. If the restriction $\gamma\beta_0 + \beta_1 = 0$ holds, the apparent effect of y_{t-1} on y_t is due to serial correlation in the errors. On the other hand, if this restriction does not hold, then y_{t-1} has an effect on y_t and we have what is known as « state-dependence ». Thus an estimate of Equation (3) and a test of the restriction $\gamma\beta_0 + \beta_1 = 0$ will enable us to discrimate between the "serial correlation model" and the "state dependence model".

Summing up, the proper procedure is to first estimate Equation (3) and test for the restriction $\gamma\beta_0 + \beta_1 = 0$. If this is not rejected, then we test for serial correlation by testing $\rho = 0$. Thus, the test for the serial correlation should be undertaken after we have determined that what we have is perhaps a serial correlation model. The use of the Durbin-Watson statistic at the beginning is not a correct procedure.

Returning to the case of panel data, the "serial correlation model" and the "state-dependence model" corresponding to Equation (4): $y_{i,t} = \beta' x_{i,t} + \alpha_i + u_{it}$ are: The serial correlation model: $\begin{cases} y_{i,t} = \beta' x_{i,t} + \alpha_i + u_{it} \\ \omega_{i,t} = \rho\omega_{i,t-1} + u_{it} \end{cases}$; The State dependence model: $y_{i,t} - \rho y_{i,t-1} = \beta' x_{i,t} + \alpha_i + u_{it}$.

CHAPTER II[20]: The effect of migrants' remittances and unpredictability of development aid inflows on fiscal consolidation in developing countries.

Abstract

We use panel data on seventy-four developing countries for the period 1980–2007 to examine the effects of aid unpredictability and migrants' remittances on fiscal consolidation in these countries. Using two definitions of fiscal adjustment and a conditional logit model to perform our analysis, evidence is shown that except for the case of low-income countries (especially gradual fiscal retrenchment), remittances increase the likelihood of fiscal consolidation, be the latter gradual or rapid. Surprisingly, we observe that aid unpredictability does not affect the adoption of fiscal consolidation measures in all the groups considered.

Keywords: Remittances; Aid Unpredictability; Fiscal consolidation.

JEL Classification: F35; F24; O23; C5.

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1. Introduction

The issue of fiscal consolidation has been largely explored in the literature the empirical literature. The latter encompasses two main strands: the impact of fiscal consolidation measures on macroeconomic variables such as growth, investment, savings….. etc, and the determinants of fiscal consolidation. Whereas the first strand of this empirical literature has been largely explored for both developed and developing countries, the second strand, apart from certain scarce studies (such as Larvigne, 2010) has focused mainly on developed countries.

In 2000, the international community committed itself to achieving eight Millennium Development Goals (MDGs) by 2015[21]. The achievement of these goals requires a substantial transfer of resources (for e.g. aid flows and migrants' remittances) to developing countries.

According to Ratha (2009), and as documented by IMF (2005), World Bank (2006) and Chami et al., (2008), remittances become an increasingly important source of external funding for a number of developing countries, going beyond the levels of foreign aid or foreign direct investment. Moreover, many scholars of whom Ratha (2005) argue that these remittances represent a stable source of funding for development.

On one side, the substantial literature on workers' remittances effects has highlighted the welfare enhancing benefits of remittances for the recipients' households, as well as their macroeconomic effects. Regarding the latter, remittances are said for example to reduce poverty rates (Adams, 2005; Gupta et al., 2009) and minimize the consumption volatility of transfer recipients through their compensatory nature (see for example, Chami, Fullenkamp and Jahjah, 2003; World Bank, 2006; IMF, 2005, Chami et al., 2009). Moreover, Chami, Cosimano and Gapen (2006) examine the Ramsey problem in general equilibrium framework and show evidence that remittances affect the setting of optimal fiscal and monetary policy in the recipient countries. They conclude that remittances, by increasing consumption, expand the revenue base and thus, allow the government to carry more debt or incur more expenditure. On the economic growth, the effect of remittances remains unclear: while certain researchers such as Chami et al. (2009b) find difficult to conclude for a linear and direct effect of them, others such as Catrinescu et al., 2009, Guliano and Ruiz-Arranz, 2009; Singh et al., 2009 find evidence that they exert a positive effect on economic growth conditioned upon some factors such as the quality of governance and the financial development.

[21] See complete list of the Millennium Development Goals in the United Nations Millennium Development Goals website at : http://www.un.org/milleniumgoals/

On the other side, the international community has adopted the concept of "predictability of aid" through the Paris' declaration (2005) of aid effectiveness. Through that declaration, donors committed to provide "better aid" for the purpose of MDGs[22].

As highlighted by Celasun and Walliser (2008), "more predictable aid would improve recipient countries' ability to plan for aid flows and allow them to more effectively execute the activities financed with such aid. Low predictability, by contrast, is costly by requiring adjustments to government consumption and investment plans with potential harmful effects on the objective attached to the spending of aid resources".

The development aid flows unpredictability is associated with reductions in government spending and/or increases in taxes (see for example, Gemmell and McGillivray, 1998). According Lensink and Morrissey (2000), aid uncertainty may negatively affect the impact of aid on economic growth. Pallage and Robe (2003) underscore that the lack of predictability due to aid delivered late compared to original plans, could at the same time be a source of procyclicality, with aid flows arriving when the economic downturn is over and reinforcing economic cycles rather than dampening them, imposing costs on economic management and reducing welfare.

Thus summing up, both types of transfers serve to feed public revenues in developing countries and thus contribute to finance the needed public goods and services of these countries to achieve their purpose of sustained economic growth and poverty reduction.

Meanwhile, evidence has been shown that OECD Donors do not honor their aid's commitments (see for example, Celasun and Walliser, 2008; Bulir and Hamman, 2001; 2003; 2005). In addition, external and domestic shocks affecting remitters in their host countries (usually developed countries) can lead to a sudden and important decline in remittances sent. In such circumstances, public finances in developing countries could be severely affected, and prompted the interest countries to adopt fiscal consolidation measures.

The main purpose of this study is to investigate the effect of external resources transfers on the decision of governments in developing countries to adopt fiscal austerity measures. In particular, we explore how migrants' remittances and the unpredictability of development aid affect the inclination of these governments' recipients to adopt fiscal adjustment measures.

The remainder of this chapter is organized as follows. The next section (section 2) reviews the literature on the fiscal consolidation issue. The following section presents our

[22] Particularly by halving extreme poverty by 2015.

definitions of 'the episodes of fiscal consolidation in developing countries'. Next (section 5), we elaborate the model to be estimated as well as the econometric technique and discuss the expected effect of explanatory variables. Subsequently, we present the data (section 6), evaluate the estimations' results (section 7) and finally conclude.

2. Review of Literature

There is a huge literature on the macroeconomic consequences of fiscal consolidation (effects on growth, interest rate, real exchange rate, current account, saving, consumption…) in both advanced and developing countries. However, among the few studies that have been devoted to the determinants of fiscal adjustment, scarce are those that focus on developing countries. We summarize here the literature on the determinants of fiscal consolidation with a special focus on developing countries.

Adams and Bevan (2003) study the variations in the persistence of episodes of fiscal stability, using a panel of 108 countries (83 developing and 25 OECD countries) over the period 1970-2000. They define persistence of fiscal stability as the length of time the cyclically adjusted conventional fiscal balance exceeds a specific threshold, where the latter is based on plausible targets values for the steady-state public debt-to-GDP ratio. The use of hazard functions based on a range of alternative deficit thresholds leads them to conclude that: OECD and developing countries on one side and, middle-income and low-income countries on the other side, differ significantly in terms of fiscal stance and the determinants of fiscal stability; in contrast with the conventional structural characteristics of the economies, the level of income plays a major role in explaining the persistence of fiscal stability; the ability of countries to maintain a sustainable fiscal stance is negatively affected by a history of poor fiscal management, with this legacy deteriorating rapidly for middle income and OECD countries and not low-income countries; fiscal stability is underpinned by revenue reforms rather than expenditure cuts, particularly for low-income countries.

Gupta et al. (2004) explore the effects of expenditure composition and other variables on the duration of fiscal adjustments episodes by the use of survival analysis on a sample of 29 developing countries over the period 1990-2000. Following the literature on that issue[23], fiscal

[23] These studies include for instance Alesina and Perotti (1995); Perotti (1998); Von Hagen, Hallet and Strauch (2001, 2002) who define episodes of fiscal consolidation as those periods in which the fiscal impulse (measured by the average cyclicality adjusted primary deficit) falls by at least 1.25 percent of GDP over two consecutive years, or when it increases by more than 1.5 percent of GDP in one year.

adjustments periods are defined as those where the observed change in the fiscal deficit as a share of GDP is above 1.5 percentage points of GDP. Moreover, fiscal adjustments are considered as continuing if the deficit falls by at least 1.5 % of GDP. They conclude that the main drivers of the persistence of fiscal adjustment are: the size of fiscal adjustment, economic growth, the composition of expenditure and past performance on fiscal consolidation. In addition, the availability of external financing is found to reduce the probability of continuing a fiscal consolidation.

Gupta et al. (2005) examine the factors that influence the persistence of fiscal adjustment in 25 emerging market countries through the period 1980-2001. They use survival analysis and more particularly an approach that defines spells of fiscal consolidation. Periods of fiscal adjustments are captured by a binary variable called "failure" and that takes the value of "0" when the annual variation of budget deficit is above 1 percentage point of GDP. Conversely, it takes the value "1" when annual change of budget deficit is lower than or equal to this threshold (lack of adjustment). Their findings[24] are of two kinds: their analysis suggests that the legacy of previous fiscal failures, the size of the fiscal deficit, the composition of spending and the level of total revenue are the main determinants of a probability of a fiscal adjustment ending. In addition, the persistence of fiscal adjustments is affected by the initial debt stock, the exchange rate developments, inflation, and the unemployment rate.

Mierau et al. (2007), in exploring the political determinants of fiscal consolidation make a distinction between rapid and gradual adjustments. A period of a rapid adjustment (in reference to Von Hagen and Strauch, 2001) is defined as that one where an improvement of the budget balance by 1.25% points in two consecutive years or an improvement of 1.5% points of the budget balance in the budgetary position is observed. A period of a gradual fiscal adjustment is captured by the use of Heylen and Everaert (2000)'s definition of fiscal consolidation: it is any period starting with an improvement of the budget balance by at least 0.25% points in the first year, a minimum duration of 2 years and a total improvement of the budget balance by at least 2% points. Using a sample of 20 OECD countries over the period 1970-2003, they obtain that both gradual and rapid fiscal adjustments are driven by initial budgetary situation (captured by the structural budget deficit and the debt-to-GDP ratio) as well as broad policy reform. Regarding the economic state, only gradual adjustments are affected by inflation.

[24] When for robustness check of their results, the authors use two alternative definition of fiscal consolidation based respectively on a change in the fiscal deficit of 0.5 percent of GDP and 1.5 percent of GDP per year, they obtained broadly similar results.

Thornton and Mati (2008) investigate the influence of exchange rate on the success of fiscal consolidation in 23 emerging market economies during the period 1970-2004. To do so, they use two definitions of fiscal consolidation: the first one defines fiscal consolidation episodes as having occurred when the improvement in the primary balance in any year is greater or equal to 0.75% of GDP. The second definition refers to any year where the improvement in the primary balance is greater or equal to 1.5% of GDP with no deterioration in the following two years. Their empirical results suggest that exchange rate depreciation raises significantly the probability of a fiscal consolidation being successful in these countries, when controlling for debt, economic growth, the composition of the consolidation and the degree of democracy.

Larvigne (2010) in contrast with the previous quoted studies explore not only the political and institutional determinants of fiscal adjustments (called "adjustment status"), but also those of the adjustments need. In other words, his study aims at determining the role of political and institutional factors that explain why countries get into fiscal distress, why some are to fiscally consolidate when required and why others are unable to adjust despite an evident need to do so. A fiscal adjustment or "adjustment status" is then defined as a continuous positive change in the primary balance amounting to at least 1.5% of GDP over a period of 5 years. For robustness check, the threshold is raised to 2.5% of GDP. An adjustment need is defined as a period of severe fiscal distress that signals a clear need for fiscal consolidation. As periods of adjustment needs are not readily observable, the author uses two ways for identifying such episodes: the screening approach and the Latent Profile Analysis (LPA).

Whilst the LPA approach focuses on clustering analysis by the use of a categorical latent variable, the screening approach remains author's the principal means of identifying years with adjustment needs. This latter approach considers an adjustment need to occur whenever the cumulative total of central government deficits over the past years is greater than or equal to 20% of GDP. For robustness check, the cumulative deficit threshold is raised to 25% of GDP.

He finds evidence that budgetary institutions play a key role in fiscal adjustment situations in developed countries: fiscal rules help avoid situations of fiscal distress whereas fiscal performance management systems improve the odds of implementing adjustments.

Regarding the developing countries, it is mainly the institutional quality that matters for fiscal adjustment need and status: whereas strong scores of broad measures of institutional quality (e.g. rule of law indices) help avoid fiscal distress situations in certain countries, weaker scores in other countries induce the latter to implement large fiscal adjustments.

The next section explains how in our study, we identify episodes of fiscal consolidation in our sample of developing countries.

3. Episodes of the fiscal consolidation in developing countries

In this study of the role of transfers (aid unpredictability and remittances transfers) on fiscal consolidation in developing countries, the fiscal consolidation variable used is a binary variable which identifies years in which a fiscal adjustment occurs in a developing country. This variable takes the value of "1" if there is a fiscal adjustment in a particular year, and "0", otherwise.

In the empirical literature of budget deficits, there is no consensus upon the criteria to be used to identify fiscal adjustments years. Adam and Bevan (2003) distinguishes usefully two approaches in the existing work: the *level approach* that ex ante defines a specific threshold and considers all countries that have a deficit smaller than this value consolidating; and the *gradient approach* which evaluates the yearly change in the deficit and considers all countries whose deficit decreases by more than a certain threshold to be in a period of fiscal consolidation.

Our study remains in the vein of the second approach and we consider here two definitions of fiscal adjustment:

The first is proposed by Alesina and Ardagna (2010) and also used for example in Alesina and Perotti (1995b, 1997), Alesina and Tavares (1998), Alesina and Ardagna (1998), Ardagna (2007): *"A period of fiscal adjustment is a year in which the cyclically adjusted primary balance improves by at least 1.5 percent of GDP".* This definition captures rapid, though large adjustments.

The second definition owes to Heylen and Everaert (2000) and captures gradual fiscal adjustment: "A period of fiscal adjustment is any period starting with an improvement in the budget balance by at least 0.25% points in the first year, a minimum duration of 2 years and a total improvement of the budget balance by at least 2% points".

To identify the fiscal consolidation episodes, the common practice in the empirical literature is to use a measure of the structural fiscal balances in relation to GDP, i.e. to abstract from the fiscal balances, the business cycle influences. However, regarding developing countries, these

business cycles influences remain weak because economic stabilizers have a small size. In fact, considering the case of sub-Saharan African countries, some authors such as Balassone and Kumar (2007) have documented that economic cycles and output gaps are particularly difficult to measure in sub-Saharan Africa for several reasons: first, structural breaks and supply shocks are frequent and data can be of poor quality; second, revenue-to-GDP ratios are generally lower and tax systems and public expenditure structures are not very sensitive to the cycle.[25] Regarding emerging market economies, Thornton and Mati (2008) have mentioned that "the limited and often rapidly changing in the economic structures of these economies can complicate the calculation of structural fiscal balances and, their less developed income tax system and social insurance systems mean that automatic fiscal stabilizers are much less effective". For that reason, they define fiscal consolidation episodes with respect to changes in the unadjusted primary balance and control for business cycle effects in their regression analysis.

In this study, for all these reasons, we follow the approach adopted by Thornton and Mati (2008) and construct our fiscal consolidation episodes with respect to changes in the unadjusted primary balance, while controlling for the effects of business cycle in the regression.

It is worth mentioning that although the two definitions of fiscal consolidation used here partly overlap, they are not identical. These definitions are applied to a sample of seventy-four developing countries spanning the period 1980–2007. The panel data thus obtained are unbalanced, with the shortest time period being T=7 years and the longest, T=27.

Appendix 1 displays the set of all the fiscal adjustment years identified. For the first definition of fiscal consolidation (that of Alesina and Ardagna, 2010), we identify a total of 457 years of fiscal adjustment over 1980–2007 (representing 27.76 per cent of the total number of observations), whereas the total is 547 years (representing 33.23 per cent of the total number of observations) for the second definition. We also identify 346 episodes for rapid and gradual adjustments occurring in exactly the same years. Among all the episodes, 111 occur with the

[25] In particular, the average revenue-to-GDP- ratio in non oil exporting Sub-Saharan African (SSA) countries is 21 percent, compared to an average revenue-to-GDP ratio of over 40% in developed countries. In addition, a large fraction of revenue in SSA is generated by indirect taxes which tend to vary proportionally to the output gap (i.e. the elasticity with respect to the output gap is close to 1). Regarding the expenditures side, a number of studies have highlighted that transfer programs are small in low-income and emerging countries. In particular, unemployment welfare and other social protection programs are not very developed (see Fatàs and Rose, 2001; Lane, 2003; Suescìon, 2007 and Thornton and Mati, 2008). Moreover, when such programs do exist, their poor countercyclical design limits their impact on declining output.

first definition without occurring with the second definition and 201 occur with the second one without occurring with the first one.

4. Model specification and econometric technique

In this section, we formulate the model that will be estimated empirically. As there is no theoretical model or unified framework that deals with the economic and political determinants of fiscal adjustments, we follow the strategy adopted by Mierau et al. (2007), who, instead of focusing on a particular theory, explore a wide range of explanatory variables.

However, as our principal variables of interest are 'aid unpredictability' and 'migrants' transfers', we focus mainly on those control variables that may affect either one of our interest variables, or both of them.

4.1 Description of the Model and the Econometric Technique

We probe the following structural model:

$$y_{it}^{*} = x_{it}^{'}\beta + \varepsilon_{it}, \qquad (1)$$

$y_{it} = 1$ if $y_{it}^{*} > 0$, and $y_{it} = 0$ if $y_{it}^{*} <= 0$

where i = 1,…n denotes the country index and t = 1,…, T_i denotes the period (year) index; y_{it} represents the adjustment status: $y_{it} = 1$ if in country i in year t the government decides to adopt fiscal consolidation measures; $y_{it} = 0$, otherwise. x_{it} is the vector of the explanatory variables (drawn from the empirical literature) that are included in the model: migrants' transfers (remittances); a measure of aid unpredictability; net aid disbursements; the primary budget deficit components (that is, the government revenue components and the primary expenditures); inflation; the annual GDP growth; an index of quality of governance; a measure of capital flight; the domestic debt stock; the output gap; the real effective exchange rate; a variable indicating whether a country is under agreement with the IMF in the previous fiscal year. We discuss below the expected sign of each these variables. ε_{it} is an error term.

Several empirical studies (for example Larvigne, 2010) use the pooled logit or probit technique to estimate this kind of model. In this chapter, we implement panel data techniques to perform our analysis. These techniques allow us to control for the presence of country-specific effects in order to avoid biased estimates.

That said, we turn now to the assumptions made regarding the error term. According to the econometric literature, we have two options:

- either a random-effects model: in this case, $\varepsilon_{it} = \nu_{it} + \mu_i$, where ν_{it} and μ_i are independent random variables; $\nu_{it} \to N(0, \sigma_\nu^2 = 1)$ and $\mu_i \to N(0, \sigma_\mu^2)$,

- or a model of fixed effects where $\varepsilon_{it} = \nu_{it} + \alpha_i * d_{it}$ and d_{it} is a dummy variable that takes the value 1 for individual i in period t, and 0 otherwise.

The most decisive factor in the choice of one of these options is the relationship between ν_{it} and μ_i: in the absence of a correlation between ν_{it} and μ_i, we should opt for the random effects. However, if ν_{it} and μ_i are correlated, then the better option is the fixed effects model.

In this study, we choose to use the fixed-effects model for the following reasons:

- although all of the developing countries could not be selected in our sample for data unavailability reasons, each country in the sample has its own economic, political and institutional characteristics that are likely to be correlated with the explanatory variables of the model. Therefore, there is a high probability of μ_i being correlated with the covariates.

- Since we opt for the model with fixed effects, the other issue is to choose between the unconditional fixed-effects estimator and the conditional fixed-effects estimator. Using the traditional unconditional fixed-effects estimator can pose certain statistical problems. In fact, applying the least squares dummy variable estimator (as in a linear panel) to this model with a binary dependent variable leads to inconsistent estimation of β in the logit model, unless $T \to \infty$. As T_i is fixed in our model, the estimators of β are not consistent: this is known as the 'incidental parameters problem', which is more severe in the cases in which T_i is small. Chamberlain (1980) provides evidence that it is not impossible to estimate the parameters of this discrete-choice model consistently and proposes conditional logit estimation. The idea of this approach consists of conditioning the likelihood function on a minimum sufficient statistic for α_i (the fixed effects). This helps avoid the incidental parameter problem. More particularly, Chamberlain (1980) argues that $S_i = \sum_{t=1}^{T_i} y_{it}$ is the suggested minimal sufficient statistic for a fixed-effects model, which in our case is the number of years of fiscal adjustments per country. Like the modelization of standard fixed effects, the conditional fixed-effects logit model focuses on the variation in the data observed within countries

(Baltagi, 2005). It is worth noting that whereas sufficient statistics are available for the logit model, they are not available for the probit model; this is the main reason for our choice of the conditional logit model.

The econometric technique of consistent estimate, which eliminates the α_i from the estimation equation, is the conditional maximum likelihood estimator (MLE). The latter is based on a log density for the i[th] individual who conditions on $S_i = \sum_{t=1}^{T_i} y_{it}$, the total number of outcomes y_{it} equal to 1 for a given individual over time. Hence, the conditional likelihood function can be written as follows: $L^c = \prod_{i=1}^{n} \frac{e^{\sum_{t=1}^{T_i} y_{it} x_{it}' \beta}}{\sum_{\sum_t d_{it} = S_i} e^{\sum_{i=1}^{T_i} d_{it} x_{it}' \beta}}$

The maximization of this equation, now free of the incidental parameters α_i, can be performed by the conventional methods.

4.2 The Temporal Dependence Issue

A concern when dealing with the binary time-series cross-section (BTSC) is modelling the temporal dependence (Beck et al., 1998), as ordinary logit or probit models may result in overly high inferences (too high t-statistics).

Beck et al. (1998) give evidence that panel logit data are identical to grouped duration data and suggest dealing with this problem by adding a series of dummy variables to the model. These dummies should capture the number of years since the previous occurrence of an 'event' (here, a fiscal adjustment). However, this solution has the drawback of leading to an important loss of degrees of freedom (due to the large number of dummy variables). Thus, Beck et al. (1998) propose as an alternative solution replacing the dummy variables with a smooth function based on cubic splines.

In this chapter, we follow Beck et al.'s (1998) suggestion and include the smooth function based on cubic splines in our model. Moreover, we follow another suggestion of Beck et al. (1998) and add another variable that captures the number of fiscal adjustments in the past (see also Mierau et al. (2007), who adopt the same procedure). This latter addition is justified by the fact that standard logit models assume the adjustments to be independent from one another, an argument that is obviously not true (Mierau et al., 2007).

4.3 Dealing with the endogeneity issue

Although the causal relationship runs from our explanatory variables to the dependent variable in our model, it is likely that there is reverse causality from the dependent variable to certain regressors, namely remittances, development aid flows, revenue components, primary expenditure, domestic debt, capital flight, output gap, inflation, GDP growth, real exchange rate, and the quality of governance. This will lead to simultaneity bias of the regression's coefficients. Note that we describe above how we transform the variable 'quality of governance' to avoid or at least mitigate its endogeneity. To address the endogeneity issue for the troublesome variables and produce less biased estimates, we choose two main options: first, we estimate the model with one-year lagged values for each of the troublesome variables; second, we use instrumental variable (IV) techniques, especially by relying on old instruments (lagged values of the troublesome variables), whereby the model is estimated using one-, two-, and three-year lagged values for the troublesome regressors quoted above. More particularly, regarding the instrumental variables' analysis, we use two alternatives approaches: the traditional two-stage least squares (henceforth, 2SLS) and a residual-inclusion approach (Blundell & Smith, 1989, 1993). For both approaches, we first estimate for each troublesome regressor an equation in which the regressor is a function of the instruments (that is, its one-, two-, and three-year lagged values) and other (non-troublesome) explanatory variables of the model. We use fixed effects and adjust the standard errors by clustering countries. These first-stage equations allow us to derive either the predicted values of each troublesome regressor that will be used in the outcome equation of interest (the conditional logit model), thus leading to the so-called '2SLS approach,' or the predicted residuals that will also be included in our outcome equation of interest, leading to the 'residual-inclusion approach.' However, the problem with the 2SLS approach is that it assumes a linear model for the second-stage estimation – whereas in our case it is a non-linear model (conditional logit model) – and the application of such a method to a non-linear model may result in inconsistent parameter estimates. This is why, to circumvent such a difficulty, Blundell and Smith (1989, 1993) showed that consistent parameter estimates can be obtained by including the predicted residuals from the first-stage estimation in the second equation (that is, the outcome equation of interest obtained using a conditional logit model). As these two instrumental variable (IV) methods include a predicted value in the outcome equation of interest, we should adjust the standard errors. However, the standard method for calculating this adjustment does not apply to the conditional logit model, rendering it impossible for us to

correct the standard errors for the 2SLS approach. We hope that such correction will not significantly change the results obtained either qualitatively or quantitatively.

In this chapter, we perform our analysis with the use of the two options highlighted above: the model with the one-year lagged values for the troublesome explanatory variables and the model with instrumental variables for these variables, in which the 2SLS approach and the residual-inclusion approach are implemented. Nevertheless, we focus on the IV based on the residual-inclusion approach, as it should yield consistent parameter estimates. It is worth mentioning that the results of the estimations do not converge when we instrument the primary expenditures and the real growth rate, respectively, by their one-, two-, and three-year lagged values. Therefore, we choose not to instrument these two variables with the old instruments and consider them with one-year lagged values in all our regressions.

5. The Discussion on the expected sign of the variables

In this part, we present and discuss the expected sign of each our explanatory variables quoted above.

5.1 Our first variables of interest: Workers' Remittances

In contrast to the development aid inflows that usually accrue to the public sector (the government), the remittances are international transfers received by private households. Expressed in terms of GDP, these remittances can be used to enhance or reduce savings depending on whether they are used more or less proportionately for consumption or savings (Griffin, 1970). Therefore, the effect of remittances on the decision to implement fiscal adjustment measures depends on the use of these inflows, that is, on their effects on the government revenue and expenditure.

If the remittance inflows are entirely saved (which is less likely to hold in developing countries), they will have no effect on the government budget and thus on fiscal adjustment measures.

Assume now that remittance receipts are not directly taxed by the government and are used to finance the domestic consumption of goods and services and/or imports (see Ratha[3], 2011). If, in the concerned economy, the domestic taxation is sufficiently broad to be able to tax consumption spending and if the trade-based taxation is large (that is, tariff revenues are an important part of the government revenue), which is the case in many developing countries –

see Gordon and Li[4] (2006) and also Abdih et al. (2009), then we can also infer that migrants' remittances, by increasing the tax base for a given level of government spending, will be likely to reduce the likelihood of fiscal adjustment. As a result, their decline will, all other things being equal, increase the likelihood of fiscal adjustment in this country, especially if the latter is a remittance-dependent one. By contrast, if the public revenue collected in the economy is mainly driven by direct taxes, then a decline in remittances will not severely affect the budget and consequently the likelihood of fiscal consolidation. In the meantime, one can also expect that remittances, by allowing higher levels of consumption and borrowing, can induce governments to take advantage of the fiscal space afforded by them. Therefore, they may reduce the incentives of governments to maintain fiscal policy discipline (Chami et al., 2008). Accordingly, the higher the migrants' remittances, the higher the likelihood that the governments will engage in excessive deficits and thus adopt fiscal adjustment measures in order to signal to the financial markets (investors) or other lenders (such as international financial institutions and bilateral donors) that their public finances are on a sustainable path.
Remittances are not only used for consumption, but are often also used to finance education or health expenditure. According to Ziesemer (2008), if workers' remittances are used by households to finance their education, the government may think that people can take care of themselves more than before and reduce the public expenditure on education. The author also contends that education may become accessible in poor countries if private and public money supports it, but not if only one of them does so. This reasoning is also valid for the health expenditure of households financed by the remittances they receive. Therefore, all other things being equal, we can expect that if remittances lead to a decline in public expenditure on education and/or health, their rise will be likely to reduce the probability of fiscal consolidation. By contrast, if the remittances spent on education and/or health supplement the public expenditure in these sectors, then they will be likely to exert no effect on the government budget and thus on the fiscal adjustment measures.

5.2 Our second variable of interest: Unpredictability of Development Aid Inflows

The concepts of "aid unpredictability" and "aid volatility" are closely related and often used interchangeably in the empirical literature. In this chapter, we make a distinction between them (see for e.g. Bulir and Hamman 2001, 2003, 2005; Fielding and Mavrotas, 2005; and DfID, 2006 for more details). Following Celasun and Walliser (2008) and Bulir and

Hamann (2001, 2003, 2005), we define predictability of aid flows as the situation where recipients can be confident about the amount and timing of aid disbursements. Celasun and Walliser (2008) listed the reasons underlying the lack of predictability (committed or expected aid differs from actually disbursed aid): failure to comply with conditionality for budget aid (which, as laid out above, may reflect different degrees of a country's performance); administrative delays in releasing budget aid; non-compliance with procedures or administrative delays for project aid; and unanticipated changes in the speed with which project activities are executed. Celasun and Walliser (2008) also highlight that the more relevant concept when studying aid effectiveness issues is "aid predictability". Conversely, aid is said to be volatile if it moves up and down significantly between two time periods. Low predictability may result in more volatile aid and, aid could simultaneously be volatile and predictable since volatile aid disbursements can in part mirror the lumpiness of spending of large investment projects (Celasun and Walliser, 2008).

Whereas volatile aid by reflecting donor efforts to counterbalance volatile economic conditions such as external shock, may be stabilizing rather than destabilizing (Chauvet and Guillaumont, 2007), low predictability (or high unpredictability) of aid leads governments to adjust their spending plans in response to "aid surprises" and thus has inherently destabilizing characteristics (Celasun and Walliser, 2008). Gemmell and McGillivray (1998) in the same vein, stress that unpredicted shortfalls in aid inflows are followed by reductions in government spending, often resulted in increases in taxes and were occasionally followed by both. According to Foster (2003), the direct costs of a shortfall in aid depend on the link between aid finance and specific expenditures. If aid is paying for the local provision of goods and services, a shortfall will cause the government to have tighter fiscal policy.

In addition, Odedokun (2003) argues that this tight of fiscal policy could also be achieved through ad hoc borrowing from the Central Bank, with associated implications for macroeconomic stability (e.g. higher inflation or crowding out of private investment).

The effect of aid unpredictability on the likelihood of a tightening fiscal policy is not obvious. In fact, when aid flows accrue to a government, the authorities have to decide what to do with that aid. Several options are available to them: the aid could be saved; it could pass directly to the private sector through tax cuts or through a direct transfer; or it could be used to substitute domestic deficit financing or to augment public expenditure (or, of course, a combination of all of the above) (Adam, 2006).

Suppose that the government decides to save the entirety of the aid received. In such a case, these capital inflows will not affect the government's budget and their unpredictability (for example an unexpected shortfall) will have no effect on the decision to adjust fiscal imbalances.

Assume now that the authorities decide to transfer the aid inflows directly to the private sector. If the trade-based taxation and the domestic taxation in such an economy are sufficiently broad, then the use by the private sector of this transfer to finance the domestic consumption of goods and services and/or imports will be likely to result in an increase in tax revenue (mainly through import tariff revenue and/or value-added and excise taxes). Consequently, the unpredictability of such aid, if not anticipated by the government, will be likely to lead to a fiscal adjustment. By contrast, if the domestic taxation in the economy is not sufficiently broad to be able to tax consumption spending and if the custom revenue components of the overall tax revenue are not important, then the domestic consumption spending and/or spending on imports by the private sector following a direct aid receipt will not affect the budget. As a result, aid unpredictability will not exert any impact on the government's budget and thus on its decision to adopt fiscal adjustment measures.

In the same vein, the government may decide to transfer the aid flows received to the private sector indirectly by cutting taxes that benefit that sector. In such conditions, these tax cuts will not, all other things being equal, reduce the tax revenue since the aid flows compensate for these tax cuts. Accordingly, the unpredictability of aid flows will not be decisive in the government's decision to adjust the government budget.

If the government anticipates the receipt of aid flows that are supposed to finance the domestic deficit, then an unexpected shortfall in this aid will be likely to lead to fiscal adjustment measures.

In a case in which the use of aid is a combination of the different options highlighted above, the effect of its unpredictability on the likelihood of fiscal adjustment will depend on the option that dominates.

Furthermore, there may be other reasons that justify a lack of fiscal consolidation effect of aid unpredictability. In effect, there is a 'herding behavior' of donors which react in a similar fashion in terms of aid supply (in many ways as private sectors) to the signals giving to them by Bretton Woods Institutions. The latter send to donors some ratings signals on the basis of the PRSP (Poverty Reduction Strategy Papers), the PRGF (Poverty Reduction and Growth

Facility) recently (in 2009) replaced by the Poverty Reduction and Growth Trust[26] (PRGT) and, the CPIA (Country Policy and Institutional Assessment) of developing countries. Accordingly, when these signals lead aid to decline short of its expected level for a developing country, it induces costly fiscal adjustments in the form of increased taxation and spending cuts. Hence, a lack of aid unpredictability effect on fiscal adjustments in developing countries may also be motivated by the two other reasons:

Firstly, the inclusion in the model of the institutional variable 'quality of governance' may, all other things being equal, cancel out any effect of aid unpredictability on fiscal consolidation in developing countries. In fact, this variable is directly related to the components of the rating signals elaborated by Bretton Woods Institutions and sent to the donors (the CPIA, the PRSP and the PRGF (now, ECF)). Thus, a country that exhibits a better quality of governance can be beneficiary of less unpredictable aid flows or at best predictable aid flows. In such circumstances, there will likely be no fiscal consolidation due to aid unpredictability.

Secondly, we are interesting on the long-run average effects of unpredictable aid flows on fiscal consolidation in developing countries. Therefore, from a statistically standpoint, regarding the high fluctuations of aid unpredictability variable (see the Figures), we are not surprised that over the medium term, such effect is statistically nil because it seems to average significant positive and negative (short term) effects over the period 1980-2007.

Overall, the effect of development aid flows' unpredictability on the government's budget and thus on the decision to adjust fiscal imbalances is uncertain and depends on the utilization of these capital inflows.

5.3 The control variables

- *The Development Aid Inflows*

Irrespective of the effects of aid unpredictability, we also expect the development aid inflows to affect the likelihood of fiscal retrenchment in developing countries through its effects on government revenues. These effects can be either positive or negative, depending on whether or not the aid flows serve to increase the tax revenues and government spending or decrease them (see the above discussion). However, in the empirical literature there is no consensus regarding the aid effect on tax revenue. Aid inflows can increase the government revenue

[26] The PRGT was established in 2009 under the newly Poverty Reduction and Growth Trust in the replacement of the PRGF.

through the improvement of customs and tax administration in developing countries (see for example, Chambas et al., 2008). Moreover, by improving the efficiency of public spending, aid could lead to an increase of public services supply and thus reinforce the tax civism (Chambas et al. 2008).

At the same time, when receive aid flows, recipients governments of developing countries can compare the social costs of each category of resources. Thus, an important flow of aid could reduce the tax effort of governments (Kaldor, 1963). However, if the macroeconomic associated costs of a surge of aid inflows are high, then tax effort is likely to increase (Chambas et al., 2008).

In addition, Azam et al. (1999) also show evidence that the low quality of institutions is likely to exacerbate the negative effect of aid flows on tax revenues. In the same vein, Chambas et al. (2008) highlight that aid inflows can affect negatively tax revenues through the low quality of government spending.

Summing up, the effects of aid on government revenue in developing countries remain uncertain. Accordingly, these effects are ambiguous on the decision to adjust or not the government budget.

- *The Real Exchange Rate*

The purpose of fiscal retrenchment to eliminate a current account deficit may result in domestic problems such as unemployment and low growth. Thus, fiscal stabilization may need to be accompanied by policies that achieve real exchange rate depreciation.

The effect of the real exchange rate depreciation may be either positive or negative on the fiscal balance, and thus on the decision to consolidate the budget, depending on the structure of the budget. One can also expect fiscal stabilization measures to affect the real exchange rate, although the specific effects in terms of appreciation or depreciation are likely to reflect the underlying economic situations. More particularly, developing countries characterized by limited capital flows tend to monetize fiscal deficits to a much greater extent than industrial countries. Consequently, fiscal consolidation (expansion) is much more unambiguously likely to lead to exchange rate appreciation (depreciation), even in the short run.

To avoid reverse causality from the fiscal consolidation to the real exchange rate, we introduce the one-year lagged values of the variable 'real effective exchange rate' into the model.

- *The Primary Budget Deficit, the capital flight and the domestic debt stock*

The primary budget variables reflect the need to adjust since there is no reason to adjust in the absence of an adverse fiscal position. However, instead of introducing in our model the primary budget as a variable, we introduce its components, that is, (the overall government revenue components (excluding aid receipts) – that is, non-tax revenue; direct tax revenue; Value added tax revenue and excises revenue and trade related tax revenue – and the government expenditure net of interest payments on public debt). This will allow us to explore whether our variables of interest affect the government's budget[5]. In fact, we expect a rise in each of the overall government revenue components (that is, the non tax revenue; the value added and excises tax; the trade taxes and the direct tax) to reduce the likelihood of fiscal consolidation, be it gradual or rapid. In the meantime, we also expect all other things being equal, that the higher the primary expenditure, the higher the likelihood of fiscal adjustment. Since the effect of remittances may translate through the public revenue (especially value added tax and excises revenue, and trade-related tax revenue), we expect in the case where the coefficient of remittances variable will be statistically significant that the component(s) through which such effect of remittances translate to be statistically nil. However, the obtained non-significant effect of such component(s) in the presence of significant coefficient of the remittances variable does not necessary mean that the remittance variable captures the effect of the revenue components on the dependent variable, since the model includes other fundamental determinants of remittances such as the real exchange rate, the growth rate, the quality of governance,..etc.

Regarding the capital flight variable, we expect a higher capital flight to increase the probability of fiscal retrenchment, be the latter gradual or rapid. Since the computation of that variable (see Table 4) includes only the external debt in addition to other macroeconomic variables and because it is the total public debt stock that matters for fiscal consolidation, we include in addition to the capital flight variable separately the domestic debt variable in our model. As the latter also reflects the need to adjust, we expect its rise to raise the probability of fiscal retrenchment (rapid or gradual) in developing countries.

- *The Inflation*

Monetary easing, by increasing inflation, can induce budget deficits and thus increase the likelihood of fiscal adjustments, as a result of the inter-relationship exists between fiscal policies and monetary policies (Mélitz, 1997; Wyplosz, 1999). Furthermore, the policy mix between the two significantly affects the level of output, prices and interest rates in the economy. Mélitz (1997) and Wyplosz (1999) provide evidence that the fiscal policy tends to relax when the monetary policy tightens, for several reasons:

- a fiscal expansion will compensate for the contraction effect on output induced by monetary tightening;
- high interest rates induced by monetary policy tightening can make new public debt titles more attractive to private investors. Thus, obtaining private financing of public works becomes easier for the government.

In the same vein, Von Hagen and Strauch (2001) show that monetary policy easing in year t increases the likelihood of starting a fiscal consolidation in year t+1. Therefore, we introduce the variable 'inflation' with one-year lagged values into the model. However, it is worth noting that if a country's debt is mainly denominated in local currency, easing monetary policy to reduce the debt level will render negative the relationship between inflation and fiscal consolidation.

- *The GDP Growth and the Economic Cycle*

Following the empirical literature, we expect fiscal adjustment to take place under favourable economic conditions like high GDP growth. However, certain countries could be forced to adopt fiscal retrenchment measures during bad times, namely when economic growth is low and financing is lacking. Once again, to avoid the simultaneity effect, we include the GDP growth variable with one-year lagged values.

The distance between the actual output and its potential level (output gap) is also an important determinant of timing fiscal adjustments. Indeed, the economic cycle may affect the budget on both the revenue side and the expenditure side. For example, during economic booms, public revenue increases as the tax revenue rises, firms will increase their profits, more employment will be created and unemployment subsidies charges will be reduced for the state. By contrast, in an economic downturn, exactly the opposite effects will transpire. This explains why adjustments tend to occur when the economy is in expansion, and rarely take place during recessions. Accordingly, we follow Von Hagen and Strauch (2001), who stress that a large

output gap increases the likelihood of fiscal adjustments being started, but reduces the likelihood of the consolidation being long-lasting. Nevertheless, during good times governments could decide to delay the adoption of fiscal retrenchment measures by lowering taxes and/or increasing spending. However, as mentioned in the previous section, the empirical literature documents that the effect of the economic cycle on the budget deficit through automatic stabilizers is more important in developed countries than in developing ones.

Summing up, we expect the output gap to exert either a positive or a negative effect on the two types of fiscal consolidation measures.

Note that we follow Larvigne (2010) in including the output gap in addition to the GDP growth (as we do not adjust the primary deficit for the economic cycle) in our model. This is justified by the fact that the GDP growth may have indirect effects on the prospects for fiscal consolidation (e.g. it may be easier to bear the political cost of adjustment when growth is strong; see Annett, 2002).

- *The IMF Programmes*

IMF programmes may have some beneficial impacts on the attempts to make fiscal efforts (Larvigne, 2010). Indeed, the IMF stabilization programme, i.e. the IMF balance of payments assistance and conditionality, could have provided incentives to countries that are subject to them to undertake a fiscal consolidation episode. Thus, we expect a positive effect of IMF programmes on the decision to adjust the fiscal position in developing countries.

- *The Quality of Governance*

The overall quality of institutions plays a key role in conducting fiscal policy: a high institution quality could foster a more efficient public sector and minimize corruption, translating into a better use of revenues and increased tax collection. Furthermore, Lane and Tornell (1999) explain that 'strong institutions can also guard against fiscal policy failing vested interests'. The indicator of institutional quality used in this chapter is the 'Quality of governance', a composite index described in the Appendix 2. We expect the good quality of governance to reduce the probability of fiscal adjustment in developing countries. As highlighted by Larvigne (2011), the use of this composite index based on subjective indexes raises issues regarding the consistency of the ratings between each other across time. Moreover, he contends that these indexes are not necessarily independent of fiscal

adjustments because despite the fact that the causal link runs primarily from political economy factors to fiscal policy, it is possible that consolidation attempts also influence political and institutional variables. To address such endogeneity issue, he transforms his initial 'institutional quality' variables by computing the average value of the past three years (not counting the current year). Hence, once transformed, this variable should be predetermined with respect to the country's current fiscal situation. Therefore, we follow Larvigne (2011) and transforms our 'Quality of governance' variable to make it predetermined with respect to the country's fiscal adjustment.

6. The Data

In this section, we discuss the measures of our principal variables of interest: the unpredictability of aid inflows and Migrants' remittances. The other explanatory variables quoted above are described in the Appendix 2. Descriptive statistics are also provided in Appendix 3.

6.1 A short literature review on the measure of the Unpredictability of Aid Inflows

We have already defined in sub-section 2 the concept of "aid unpredictability". Here, we discuss the measure of "aid unpredictability".

Bulir and Hamann (2008) argue that aid commitments tend to be used in budgetary exercises in recipient countries, mainly as a result of pressures from donors. Bulir and Hamann (2001, 2003, 2008) find evidence that commitments systematically exceed disbursements and that aid cannot be predicted reliably on the basis of commitments: aid commitments are a poor predictor of aid receipts and incorporating the predicted aid inflows into fiscal planning can be costly. Note however that these findings are obtained on the basis of an autoregressive model where the total gross aid disbursements (take in difference) are regressed on their lagged value and on total aid commitments (also take in difference). The regression is performed for each of the 71 countries of the sample with data covering the period 1975-1997.

In addition, another finding of their study is that several episodes of spikes in commitments were not generally followed by increased disbursements. This finding based on Bulir and

Hamann (2001, 2003, 2008), compares total debt commitments with disbursements of long-term debt reported by the World Bank's Global Development Finance database[27].

Vargas Hill (2005) in examining the issue of how the significant financial flows of ODA affects the stability of least developed countries, carries out a simple econometric analysis of the ability of aid commitments to predict aid disbursements. Out of a sample of 112 ODA recipients, she finds for 53 countries that commitments do not predict disbursements. For 52 countries, commitments have predictive power for disbursements at the 5% level of significance and for one country (Trinidad and Tobaggo), the coefficient on commitments was negative and significant. The coefficient was less than one, with an average of 0.5 for all but one of the countries for whom the coefficient on commitments was positive and significant at the 5% level. This suggests that only half the changes in commitments are realized in changes in disbursements. She draws the conclusion that for many countries of her sample, aid is unpredictable (as well as volatile - though we are not dealing with this issue here): commitments nearly always exceed actual disbursements and, commitments are a poor indication of what actual disbursements will be.

Pallage and Robe (2001) document empirical regularities in the foreign aid flows to developing countries. Their study covers 63 recipients and 18 donor countries between 1969 and 1995. Among other results, they observe that "commitments for all sources are typically larger than disbursements". In fact, for African recipients countries, aid flows promises exceed aid received by on average 2% of GDP[28], whereas for other countries than Africa, the firm promises to disburse exceeds on average 1% of GDP the actual aid disbursements. The authors explain the always exceed of commitments over disbursements by the fact that disbursements are net of possible principal repayments, whereas gross commitments are not.

Celasun and Walliser (2008) examine the predictability of aid flows in 60 low income countries during 1990-2005 by analyzing patterns of aid commitments and disbursements in these countries. They compute the aid unpredictability measure by country and region as the absolute deviation in percent of GDP of committed and disbursed aid. Indeed, for each country of their sample, they calculate the absolute value of the difference between aid disbursements and commitments (that is the average value of periods of excess aid or aid

[27] Data on disbursements and commitments for technical cooperation suggests no clear pattern on whether technical cooperation aid is more predictable than the other types of aid. The deviations from commitments as a share of disbursements are broadly comparable in magnitude for technical cooperation and overall aid; the deviations are smaller for technical cooperation in roughly half of the sample.

[28] More particularly, total aid disbursements to Sub-Saharan Africa exceeded commitments in almost every year since 1990 (Pallage and Robe, 2001).

shortfalls) over the whole period 1990-2005. They find evidence that on average, many aid recipients countries receive aid disbursements that exceed aid commitments. This finding contrasts with the general belief that donors rarely keep their aid promises and systematically disburse less than they commit. Especially, it contrasts with the results obtained by Pallage and Robe (2001) and Bulir and Hamann (2001, 2008).

In this chapter, we construct our measure of aid unpredictability by relying upon an equation.

6.2 The Measure of Unpredictability of Aid Inflows

Our measure of aid inflows' unpredictability refers to Levy (1987) where a measure of permanent aid is computed and from which we deduce our measure of aid unpredictability. Indeed, according to Levy (1987), commitments of future aid transfers are outcomes of dialogues and series of negotiations between donors and recipients. Therefore, transfers in time t reflect commitments made in the past, together with cancelled commitments and unanticipated flows of emergency aid. Accordingly, as mentioned by Levy (1987), since recipients are involved in the process that generates these commitments, they can estimate the probable level of these regular or permanent flows of aid. We follow the approach of Levy (1987) for the estimation of the anticipated permanent flow of foreign transfers. This approach consists of approximating these anticipated permanent flows by the predicted values obtained from an "aid earnings" or supply function, that is, a stable relationship between aid flows and past commitments. Hence, for a given country, we express the anticipated (or permanent) aid flows as a distributed lag of past commitments:

$A_t^P = f(A_{t-1}^C, A_{t-2}^C, A_{t-3}^C, ...)$ (1) where A_t^P and A_t^C are respectively permanent aid in % of GDP and gross aid commitments in % of GDP.

Since we cannot observe A_t^P, we will estimate it by regressing net aid disbursements (in percentage of GDP) on past (gross) aid commitments (in % of GDP) as follows:

$$A_t = \alpha_0 + \alpha_1 A_{t-1}^C + \alpha_2 A_{t-2}^C + \alpha_3 A_{t-3}^C + \alpha_4 A_{t-4}^C + e_t \quad (2)$$

Where A_t^C is the total (gross) aid commitments in percentage of GDP for a given country in year t, t=1980,…., 2007; A_t is the total net aid disbursements in percent of GDP at year t ; e_t is an error term.

From the equation (2), we can obtain a measure of permanent aid flows ($\widehat{A}_t^P$) as well as a measure of unpredicted transfers that are transitory in nature ($\widehat{A}_t^T$): $\widehat{A}_t^T = A_t - \widehat{A}_t^P$.

The estimation of this equation is performed for each country. The number of lagged values of aid commitments which is significantly related to aid transfers varies from country to country: it swings between 1 and 4 because additional lags appear to be statistically insignificant. In the estimation equations, we always correct for heteroscedasticity as well as autocorrelation in errors (using the Cochrane Orcutt technique).

6.3 Measuring the Remittances

Since our second variable of interest is the migrants' remittances, its measure matters for our estimation results. The discussion here is based on Chami et al. (2008). Remittances are defined in the empirical literature (see for example Ratha, 2003) as 'unrequited, non-market personal transfers between households across countries'. When compiling statistics on the balance of payments, three components of remittances are taken into account: workers' remittances, employees' compensation and migrants' transfers (see Chami et al., 2008 for more details):

- The first component (the worker's remittances) records current transfers by migrants who are employed in, and considered a resident of, the countries that host them.
- The employee compensation is composed of wages, salaries, and other benefits earned by individuals in countries other than those in which they are resident (for e.g. earning of seasonal works and embassy employees).
- The third component, the migrants' transfers are contra-entries to the flows of goods and changes in financial items that arise from individuals' change of residence from one country to another.

As highlighted by Chami et al. (2008), when studying the macroeconomic effects of remittances, the choice of the measurement of remittances matters. According to them, among these three categories of remittances, workers' remittances most closely conform to the notion that researchers and policymakers have in mind when discussing remittances flows. The authors criticize the common practice in the empirical literature that consists of summing the three categories when compiling statistics on remittances. They demonstrate through their exercise that data in the categories of workers' remittances, employee compensation, and migrants' transfers capture different behavioral characteristics. Therefore, they draw the

conclusion that the inclusion of migrants' transfers and employee compensation in remittances statistics are likely to pose problems and, researchers who use all three series when compiling a cross-country panel of remittances data may be making a serious error.

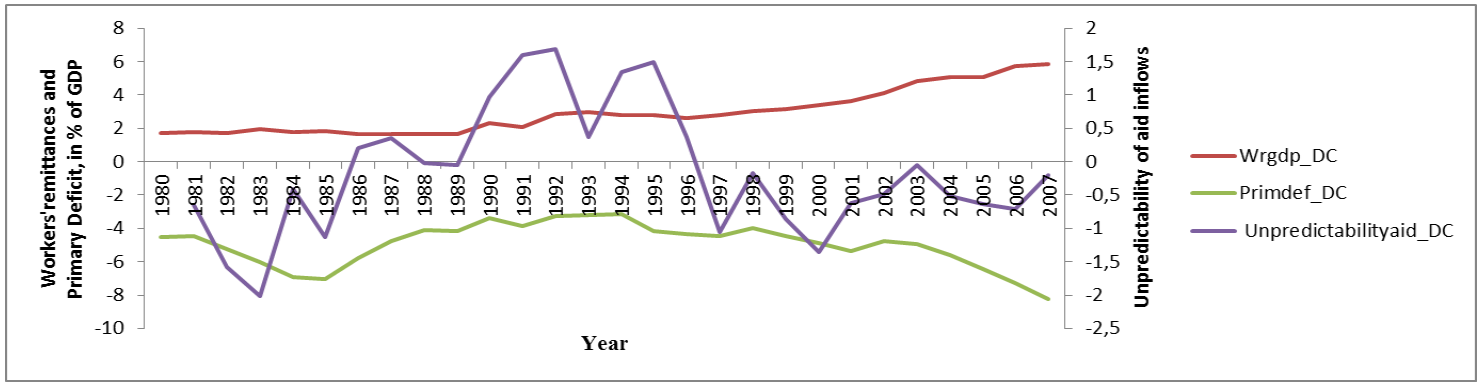
Based on this conclusion, they recommend to use the data series on workers' remittances (series in the World Bank Development Indicators – WBDI which best reflect the behavioral aspects that are trying to be captured) when conducting any econometric or statistical analysis and draw conclusions regarding remittance behavior.

Following the criticism and recommendation of Chami et al. (2008), we choose to use as our main remittance variable "the workers' remittances" that we scale by the Gross Domestic Product.

The figures below compare the evolution of our variables of interest (workers' remittances and development aid unpredictability) with that of the primary deficit. These figures will gives us an insight into the relationship between these variables and the government budget.

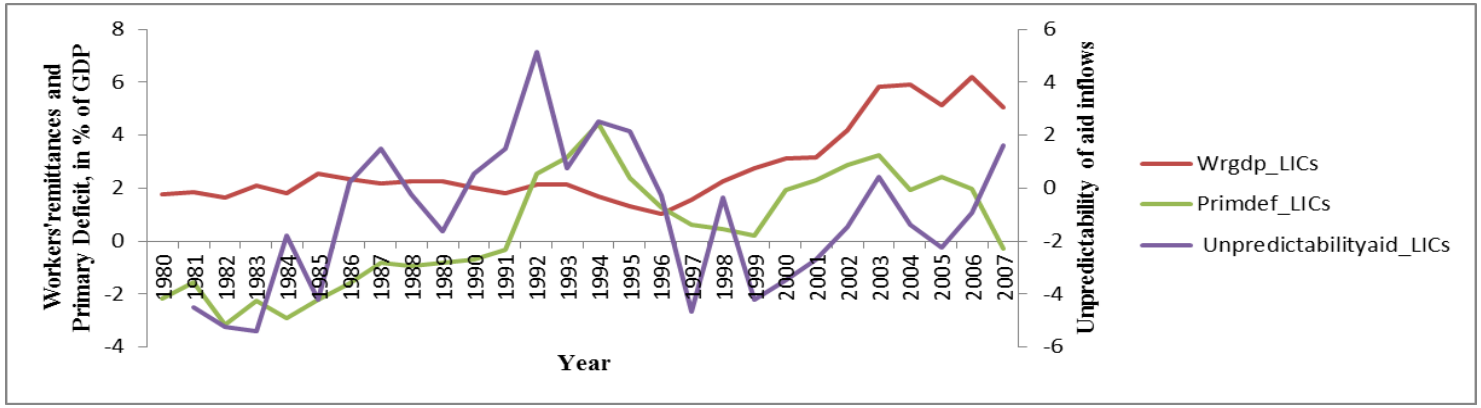
From the figure 1 we cannot conclude for a clear relationship between the evolution of workers' remittances and the primary deficit on one side and, the aid unpredictability and the primary deficit, on the other side. Nevertheless, it is worth mentioning that the remittances exhibit a rising trend over time, whereas the unpredictability of aid flows fluctuates over time. For LICs (see Figure 2), between 1980 and 1995, while remittances display a slow declining trend, the primary deficit is increasing. After that period, especially between 1997 and 2007, these two variables appear to be positively correlated. Regarding the aid unpredictability variable, we cannot conclude for the direction of its correlation with the primary deficit. For the group of top 30 remittance-dependent countries, workers' remittances are positively correlated with the primary deficit over time whereas the relationship between aid unpredictability and the primary deficit remains unclear (see Figure 3).

Figure 1: Evolution of workers' remittances, aid unpredictability and primary deficit in the developing countries



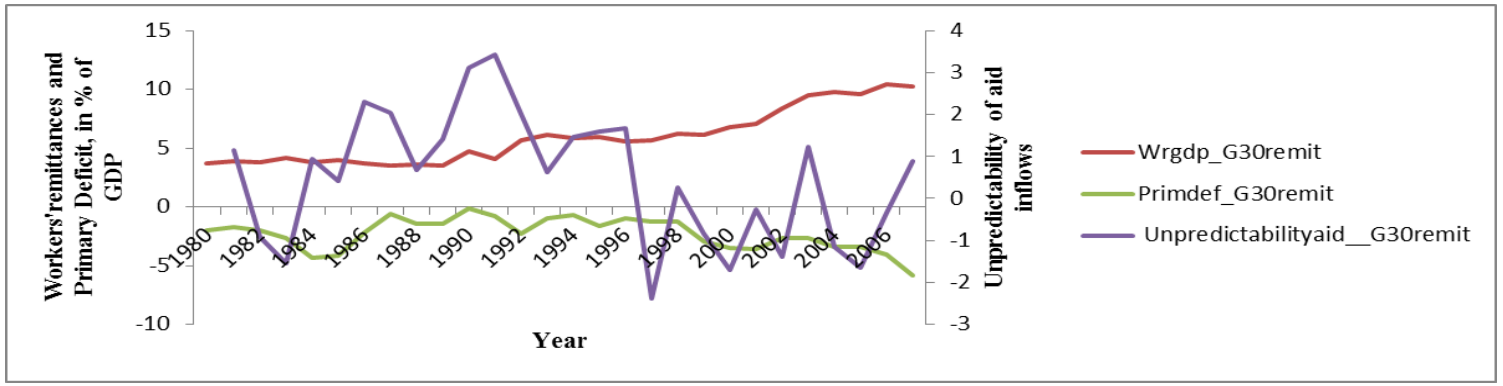
Source: Author calculation based on data from CERDI's public finance database and World Development Indicators (2011).

Figure 2: Evolution of workers' remittances, aid unpredictability and primary deficit in the LICs



Source: Author calculation based on data from CERDI's public finance database and World Development Indicators (2011).

Figure 3: Evolution of workers' remittances, aid unpredictability and primary deficit in the group G30remit



Source: Author calculation based on data from CERDI's public finance database and World Development Indicators (2011).

7. Evaluation of the results

In this section, we present and analyze the empirical results obtained from the estimations of our conditional logit model. This analysis will primarily focus on our variables of interest (namely, the unpredictability of aid and the migrants' remittances), although we will also analyse the results obtained from the control variables.

The estimations are performed using our two measures of fiscal consolidation ('FCAlesina' and 'FCHeylen') on different types of samples: the full sample of developing countries and two sub-samples: low-income countries (LICs) and the group of the 30 top remittances dependent countries of our sample (denoted G30remit). Before proceeding with the interpretation of our results, we find it useful to mention that as our model is a conditional logit one in which fixed or individual effects are not eliminated, it will not be possible for us to compute the marginal effects. This is why we opt for another way of intuitively interpreting these results: the use of an odds ratio analysis.

From equation (2), the probability of an occurrence of fiscal consolidation to the probability of a non-fiscal consolidation is given by $e^{x'\beta}$. The differentiation of this expression with respect to any of the regressors (x_k) leads us to obtain e^{β_k}. The meaning of this is: for any unitary change in x_k, the odds will change by a factor of e^{β_k}, holding all other variables constant.

In Table 1 (see below), we report the joint F-test conducted on the three instruments (one-, two-, and three-year lagged values) of each troublesome explanatory variable. The results provide evidence that in all cases these instruments are good predictors of the explanatory variables.

Table 1: Joint F-test on the instruments of the first stage equation for the Instrumental Variable (IV) techniques

	Full Sample: Developing Countries	**LICs**	**Group of Top 30 Remittances**
Variable	**Results of Joint F- test**	**Results of Joint F- test**	**Results of Joint F- test**
Log(Remit)	82.01 (0.0000)	17.86 (0.0000)	113.78 (0.0000)
Log (Net ODA)	115.05 (0.0000)	44.09 (0.0000)	118.96 (0.0000)
Domesticdebtgdp	38.68 (22.30)	15.10 (0.0000)	7.63 (0.0007)
Capitalflightgdp	22.30 (0.0000)	10.86 (0.0003)	24.13 (0.0000)
Outputgap	191.89 (0.0000)	65.34 (0.0000)	11.89 (0.0000)
Inflation	900.84 (0.0000)	14.05 (0.0001)	904.78 (0.0000)
Log(REER)	36.10 (0.0000)	181.49 (0.0000)	11.81 (0.0000)

Note: The first stage equation for each of the seven explanatory variables, we include 1, 2 and 3 years lagged values; the variable 'Primaryexpendituregdp' and 'GDP_Growth' are considered with one year lagged values and included in the different equations as non-troublesome explanatory variables. This is because when these two variables are included (non lagged) in the model, the estimations results do not converge.

Table 2 of the Appendix presents the estimation results for the full sample (the developing countries) when using as our two dependent variables 'FCAlesina' and 'FCHeylen.' Table 3 in the Appendix presents the estimates of the model based on instrumental variables, in which the predicted residuals are included in the outcome equation of interest for our two sub-samples.

Let us start with the first table of results (Table 2). This table is divided into three compartments: in the first compartment, we report the results of the conditional logit model, in which one-year lagged values of the troublesome regressors quoted above are used (denoted 'model 1'); in the second compartment, we present the results of the 2SLS approach (denoted 'model 2'); and the third compartment reports the results of the instrumental variable based on the residual-inclusion approach (denoted 'model 3'). We observe from this table and irrespective of the type of fiscal adjustment measure ('FCAlesina' and 'FCHeylen') that in almost all the cases the conditional logit model estimates (model1) produce smaller coefficients (in absolute values) than the estimates from the two models with instrumental variables (model 2 and model 3). In Table 2 (Columns 2 and 5), the student test for the individual duration dependence variables and the joint F-test on these variables suggest the absence of significance at the 10 percent level. Accordingly, we can infer that there is no duration dependence in the decision made by developing countries (as well as the full sample and the sub-samples) to adopt rapid fiscal adjustment measures. By contrast, the same tests in Table 2 (Columns 3 and 6) reveal the presence of significant duration dependence of the inclination of developing countries (the full sample and the sub-samples) to adopt gradual fiscal austerity measures. However, for the duration dependence variables in Columns 8 and 9 of Table 2 (the model with IVs based on the residual-inclusion approach), the results suggest evidence of significant duration dependence in the developing countries' decision to adopt either rapid or gradual fiscal adjustment measures.

Table 2: The Impact of Aid Unpredictability and Migrants' Remittances on Fiscal Consolidation – The full sample of developing countries

Model 1: With one year lagged values of some troublesome explanatory variables			*Model 2: With the Instrumental Variables: The Predicted Values of some troublesome explanatory variables*			*Model 3: With Instrumental Variables: the residual inclusion*		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	'FCAlesina'	*'FCHeylen'*		*'FCAlesina'*	*'FCHeylen'*		*'FCAlesina'*	*'FCHeylen'*
Regressors			Regressors			Regressors		
$Log(Remit_{t-1})$	0.473***	0.355***	Predicted (Log(Remit))	1.016***	0.931***	Log(Remit)	1.179***	1.009***
	(0.136)	(0.138)		(0.250)	(0.260)		(0.285)	(0.280)
Unpredictability	0.0304	0.0249	Unpredictability	0.0357	0.0639	Unpredictability	0.0191	0.0239
	(0.0262)	(0.0322)		(0.0497)	(0.0519)		(0.0605)	(0.0620)
$Log(Net\ ODA)_{t-1}$	-0.418**	-1.058***	Predicted (Log(Net ODA))	-1.678***	-2.532***	Log(Net ODA)	-2.073***	-2.876***
	(0.211)	(0.271)		(0.454)	(0.566)		(0.536)	(0.632)
$Nontaxrevenuegdp_{t-1}$	-0.104**	-0.159***	$Nontaxrevenuegdp_{t-1}$	-0.120**	-0.240***	$Nontaxrevenuegdp_{t-1}$	-0.106	-0.199***
	(0.0449)	(0.0508)		(0.0587)	(0.0640)		(0.0676)	(0.0657)
$Directtaxesgdp_{t-1}$	-0.0741	0.0170	$Directtaxesgdp_{t-1}$	-0.0734	0.113	$Directtaxesgdp_{t-1}$	-0.118	0.00507
	(0.0610)	(0.0757)		(0.0737)	(0.109)		(0.0852)	(0.128)
$Vatexcisesgdp_{t-1}$	-0.109	-0.0520	$Vatexcisesgdp_{t-1}$	-0.104	-0.227**	$Vatexcisesgdp_{t-1}$	-0.122	-0.256**
	(0.0833)	(0.0849)		(0.0986)	(0.104)		(0.109)	(0.112)
$Tradetaxesgdp_{t-1}$	-0.318***	-0.379***	$Tradetaxesgdp_{t-1}$	-0.199	-0.128	$Tradetaxesgdp_{t-1}$	-0.170	-0.112
	(0.102)	(0.106)		(0.175)	(0.135)		(0.203)	(0.143)
$Primaryexpendgdp_{t-1}$	0.190***	0.286***	$Primaryexpendgdp_{t-1}$	0.210***	0.348***	$Primaryexpendgdp_{t-1}$	0.245***	0.406***
	(0.0389)	(0.0476)		(0.0469)	(0.0579)		(0.0554)	(0.0705)
$Domesticdebtgdp_{t-1}$	-0.00347	-0.00280	Predicted (Domesticdebtgdp)	0.0378	0.0692*	Domesticdebtgdp	0.0269	0.0469
	(0.00391)	(0.00461)		(0.0572)	(0.0367)		(0.0700)	(0.0394)
$Capitalflightgdp_{t-1}$	-0.000310	0.000631	Predicted (Capitalflightgdp)	-0.000765	0.0015	Capitalflightgdp	-3.49e-05	0.00272
	(0.000455)	(0.000576)		(0.00118)	(0.0015)		(0.00128)	(0.00166)
$Outputgap_{t-1}$	-2.62e-12	-1.14e-11*	Predicted (Output_gap)	3.53e-12	-9.09e-12	Outputgap	1.91e-12	-3.39e-12
	(6.55e-12)	(6.91e-12)		(6.61e-12)	(7.37e-12)		(7.05e-12)	(8.74e-12)
$Inflation_{t-1}$	-0.000309	-0.000740	Predicted (Inflation)	0.000265	-0.00316**	Inflation	-0.0103	-0.0152
	(0.000687)	(0.000645)		(0.00142)	(0.00155)		(0.00819)	(0.0153)
$GDPGrowth_{t-1}$	-0.00274	-0.00188	$GDPGrowth_{t-1}$	0.0179	0.0243	$GDPGrowth_{t-1}$	0.0122	0.00902
	(0.0255)	(0.0306)		(0.0346)	(0.0379)		(0.0387)	(0.0414)
$Log(REER)_{t-1}$	-1.544***	-1.709***	Predicted (Log(REER))	-2.884***	-2.824***	Log(REER)	-3.613***	-3.198***

	(0.552)	(0.603)		(0.890)	(0.972)		(1.068)	(1.165)
IMF	-0.116	-0.110	IMF	0.109	0.122	IMF	0.144	0.0645
	(0.258)	(0.295)		(0.296)	(0.337)		(0.316)	(0.362)
Qog	-3.038**	-7.763***	Qog	-3.694***	-10.01***	Qog	-3.771**	-10.98***
	(1.325)	(1.831)		(1.428)	(2.057)		(1.529)	(2.381)
NumberfcAlesina/Heylen	-0.545***	-1.733***	NumberfcAlesina/Heylen	-1.145***	-2.765***	NumberfcAlesina/Heylen	-1.400***	-2.909***
	(0.128)	(0.232)		(0.285)	(0.340)		(0.341)	(0.373)
VariablefcAlesina/Heyle	-0.127**	-0.622***	VariablefcAlesina/Heylen	-0.177**	-0.626***	VariablefcAlesina/Heylen	-0.190**	-0.759***
	(0.0635)	(0.0820)		(0.0723)	(0.0882)		(0.0799)	(0.109)
Spline1	-0.000929	-0.00532***	Spline1	-0.00115	-0.00416***	Spline1	-0.00161	-0.00479***
	(0.000838)	(0.00126)		(0.000946)	(0.00139)		(0.00102)	(0.00148)
Spline2	-0.00110	-0.0112***	Spline2	-0.00248	-0.0114***	Spline2	-0.00468	-0.021***
	(0.00288)	(0.00374)		(0.00348)	(0.00412)		(0.00406)	(0.006)
Spline3	0.000374	0.0108**	Spline3	0.00243	0.0105*	Spline3	0.00499	0.017***
	(0.00299)	(0.00480)		(0.00367)	(0.00545)		(0.00426)	(0.0065)
Test on Spline1	1.23 (0.2675)	17.75 (0.0000)	Test on Spline1	1.48 (0.2235)	8.95 (0.0028)	Test on Spline1	2.49	10.48 (0.0012)
Test on Spline2	0.15 (0.7013)	8.90 (0.0028)	Test on Spline2	0.51 (0.4755)	7.66 (0.0056)	Test on Spline2	1.32	11.74 (0.0006)
Test on Spline3	0.02 (0.9004)	5.06 (0.0245)	Test on Spline3	0.44 (0.5073)	3.73 (0.0534)	Test on Spline3	1.37	6.76 (0.0093)
Test on variable	3.97 (0.0464)	57.52 (0.0000)	Test on variable	6.00 (0.0143)	50.29 (0.0000)	Test on variable	5.63	48.81 (0.0000)
Joint F-test on 'duration dependence' variables	4.40 (0.3540)	58.80 (0.0000)	Joint F-test on 'duration dependence' variables	7.69 (0.1038)	55.11 (0.0000)	Joint F-test on 'duration dependence' variables	8.81 (0.066)	55.8 (0.0000)
LR	85.81 (0.0000)	225.92 (0.0000)	LR	93.72 (0.0000)	237.10 (0.0000)	LR	120.58	255.51 (0.0000)
Log-likelihood	-263.24601	-211.81307	Log-likelihood	-221.89553	-172.54185	Log-likelihood	-195.21542	-151.03689
Countries–observations	55-709	49-664	Countries–observations	50-624	43-581	Countries–observations	48-597	41-555

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01.

Note also that for sake of brevity, we do not report the results obtained for residual stemming from the first stage of instrumental variable model in the case of the residual-inclusion based approach. These results could be obtained upon request.

Furthermore, for all the estimates in Table 2, the coefficient of the variable indicating the number of prior adjustments is negative and always highly significant. However, this variable is merely used here as a covariate in order to ensure conditional independence between spells of adjustments and thus will have no substantial meaning here.

Let us turn now to the interpretation of our estimation results in Table 2.

As previously mentioned, the results of model 1, model 2, and model 3 differ in the size of the estimates and the standard errors. Note, however, that the results obtained from the two instrumental variables (see model 2 and model 3) are similar. For the interpretation of our results, we will rely on model3's results, that is, the model with instrumental variables based on the residual-inclusion approach (see Columns 8 and 9 of Table 2). These results suggest that workers' remittances increase the probability of both rapid and gradual fiscal adjustments in developing countries and thus confirm our hypotheses that more remittances, by allowing greater fiscal space, lead governments to relax their fiscal discipline and make unavoidable fiscal adjustment in year t. In addition, the coefficient estimates of the variables capturing the components of government revenue are not statistically significant for the case of 'rapid fiscal consolidation' (that is, FCAlesina), whereas the primary expenditure appears to exert, as expected, a positive effect on the likelihood of rapid fiscal adjustment in developing countries. This may imply that, irrespective of the other explanatory variables, the effect of remittances on the inclination of developing countries' governments to adopt fiscal consolidation measures translates mainly through government revenue. However, as we mentioned above, the non-statistically significant effect obtained for the variables capturing government revenue components may be due to the presence in the model of other variables, such as the real exchange rate or development aid flows, which are highly significant here and which may have absorbed the significance of the public revenue's components in our model. Concerning the 'gradual fiscal adjustment' variable (FCHeylen) (see Column 9 of Table 2), for which the significance of the positive effect of remittances is obtained in the presence of the significance (positive expected effect) of the primary expenditure, we find that among the revenue components, only two (non-tax revenues and indirect taxes) are statistically significant with the expected negative sign, whilst the other two (direct taxes and trade taxes) are not. This may suggest that the remittances' effects on the decision of policymakers in developing countries to adopt gradual fiscal tightening measures translate, among other variables, through these two non-significant components of public revenue (that is, direct taxes and trade taxes). If this is the case, it means that remittances contribute significantly to the trade taxes as well

as to the direct taxes in these countries. A more detailed analysis relying on the group of top 30 remittance-dependent countries of our sample will provide us with a better insight into whether the remittances' effect on fiscal consolidation really translates through, among other variables, the public revenue, and if so, which components of revenue are concerned.

The unpredictability of aid inflows appears to exert no significant effect on the likelihood of both rapid and gradual fiscal adjustments. The explanation for such results is rooted in one of several hypotheses made above (that is, on the utilization of aid or because of the control variables, especially the 'quality of governance' – see section 5), which leads us to conclude that 'aid unpredictability does not affect fiscal consolidation.'

What about the other control variables?

Among the other control variables, we observe that a higher level of the net aid disbursements, an appreciation of the real exchange rate, and a better quality of governance reduce the probability of either rapid or gradual fiscal tightening measures in developing countries. The coefficients of the remaining explanatory variables are statistically non-significant.

Consider now the results for our sub-samples. They are reported in Table 3, in which the conditional logit model is primarily estimated with the use of (old) instrumental variables based on the residual-inclusion approach. However, for the sub-sample of low-income countries (LICs), the estimates do not converge when regressions are performed for the dependent variable 'FCHeylen.' Since we observe evidence for the full sample of developing countries that the results of the two instrumental variable approaches (2SLS and residual-inclusion approach) are similar, we decide to rely in this specific case on the second-best option, that is, the estimations based on the 2SLS approach.

Columns 1 and 2 present the results of the dependent variables 'FCAlesina' and 'FCHeylen' associated with the sub-sample of the group denoted G30remit. Columns 3 and 4 present the results of respectively the same dependent variables associated with the sub-sample of LICs (low-income countries).

Regarding the group of remittance-dependent economies, the results are suggestive of a strong positive and significant effect of remittances on the inclination of developing countries' governments to adopt either gradual or rapid fiscal adjustment measures. In the case of rapid fiscal adjustment, neither the revenue variables nor the primary expenditure variable are statistically significant. This may suggest that the effect of remittances on the fiscal consolidation variable translates through the government budget (the revenue and expenditure

variables). In other words, remittances seem to contribute significantly to the public revenue of this group of countries. However, we are unable to determine with precision which components of revenue are the most concerned. In the case of gradual fiscal adjustment, the primary expenditure appears to be (as expected) positively related to the dependent variable (though only at the 10 percent level of statistical significance) and, among the revenue variables, only the non-tax revenue variable is significant with the expected negative sign. Once again, this result may suggest that, in this sub-sample, remittances contribute substantially to the government revenue, especially through direct, indirect, and trade taxes; this may be why the positive effect of remittances on gradual fiscal adjustment is obtained in the presence of a non-statistically significant effect of the components of revenue other than non-tax revenue.

The unpredictability of aid flows appears once again to exert no significant effect on the inclination of the government of this sub-sample's countries to adopt gradual or rapid fiscal retrenchment measures. This probably reflects the hypotheses outlined in the discussion on the effect of this variable on our dependent variable, for which we conclude an absence of an effect of this variable.

Regarding the other control variables, the higher the levels of development aid flows, output gap, and real effective exchange rate (appreciation), the higher will be the G30remit group countries' inclination to adopt gradual fiscal retrenchment measures to put their public finances on a sustainable path.

Column 3 of Table 3 reveals that, all other things being equal, remittances affect the likelihood of rapid fiscal tightening in LICs positively and significantly, and the revenue variables are not statistically significant, whereas the coefficient of the primary expenditure variable is positive and exhibits the expected sign. The reasoning put forward above concerning such a result also applies here. Moreover, aid unpredictability does not affect the likelihood of rapid fiscal adjustment in LICs. This result suggests that LICs, although highly dependent on the concessional resources, do not adopt rapid fiscal adjustment measures because of, for instance, an unexpected shortfall in the aid flows that were expected to be received. In the meantime, a higher level of domestic debt, real effective exchange rate depreciation, and the implementation of IMF programs seem to raise the likelihood of LICs adopting rapid fiscal tightening measures. With respect to the gradual fiscal tightening measures in LICs, remittances exert no significant effect and such measures are driven by lower non-tax revenue and an increase in primary expenditure. Note finally that all the results

obtained for the LICs group should be read with caution since they rely on a small number of countries due to the lack of data, especially regarding the variable 'quality of governance' for many of the countries of that group.

8. FURTHER ANALYSIS

In our previous analysis, we have explained the lack of significance of the fiscal policy (especially revenue) variables by asserting that the remittances variable (and perhaps ODA variable) is the driving force behind the receipts. In this part, we try to check this by using different interaction terms between 'remittances' and fiscal policy variables (both revenue variables and expenditure variable) in the model on one hand and 'Development Aid' variables (the ratio of ODA over GDP and the aid unpredictability) and fiscal policy variables (both revenue variables and expenditure variable) on the other hand in the model. To perform our analysis, we first discuss the econometric method for the estimation – given the fact that our dependent variable is binary - and then present the estimations' results.

8.1 Discussion on the econometric method

The econometric literature has started discussing how to treat empirically models with a binary dependent variable and which contains interaction explanatory variables. Although there is not yet a conclusion regarding the best way to estimate non-linear models with interaction terms, some consensus seems to appear with regard to the fact that in non-linear models (for e.g. logit, probit or conditional logit models), we could neither interpret the sign nor the magnitude of the interaction coefficient that will be obtained.

Indeed, Ai and Norton (2003)[29] show that the marginal effect of an interaction term in nonlinear models, as provided by standard econometrics packages, may hold the wrong sign and significance and, consequently, cannot be interpreted as such. Greene (2010) challenges the way of interpreting Ai and Norton's (2003) results and notes that 'the process of statistical testing about partial effects, and interaction terms in particular, produces generally uninformative and sometimes contradictory and misleading results. The mechanical reliance on statistical measures of significance obscures the economic, numerical content of the

[29] According to these authors, the interaction effect is based on cross-partial derivatives with respect to the two interacted variables, which makes the sign and significance of the interaction term different for observations. They thus recommend relying on these derivatives and using the Delta method to assess the statistical significance of the marginal effect associated to the interaction term.

estimated model' (p. 295). He recommends performing the analysis not only through statistical procedures (see Greene, 2010 for details) but also by graphical presentations. Kolasinski and Siegel (2010) also criticise Ai and Norton's (2003) interpretation of the interaction term. They first contend that in Ai and Norton's (2003) results 'it is difficult to interpret the sign of interaction term coefficient because for some observations, the cross partial derivative of the probability of occurrence with respect to interacted covariates can have the sign opposite to that of the interaction term coefficient'. They argue that this is because of a mechanical saturation effect[30], which is irrelevant for researchers primarily concerned with proportional marginal effects. For such researchers, small changes in probability are more important near the boundaries than they are near the centre. Kolasinski and Siegel (2010) conclude that the interaction term coefficient (provided by nonlinear logit or probit regressions) remains a valid measure of interaction because it is already purged of the saturation effect. Consequently, they suggest researchers who are not concerned with the saturation effect, use it as such, while others (those for whom the mechanical saturation effect is important) use Ai and Norton's (2003) measure of interaction.

Overall, this ongoing discussion does not lead to a best way of obtaining good interaction terms and interpreting them in nonlinear models. Since our dependent variable is binary (a dummy), an alternative way of estimating our model is the linear probability model (LPM) where the probability of success and failure is considered to be a linear function of the covariates. Despite the concerns associated with this method and particularly the fact that in contrast to non-LPMs (for e.g., Logit or probit models) the predicted probabilities of success or failure in an LPM may lie out of the interval [0,1], the LPM has the advantage to allow us for easily interpreting interaction terms (the coefficients of the interaction variables). Moreover, Wooldridge (2002: 455) highlights that 'if the main purpose is to estimate the partial effect of the explanatory variables on the response probability, averaged across the distribution of these covariates, then the fact that some predicted values are outside the unit interval may not be very important. The linear probability model needs not provide very good estimates of partial effects at extreme values of the covariates'. In the same vein, Cameron and Trivedi (2005: 495) mention that ordinary least squares (OLS) estimations of such models provide a good guide to which variables are statistically significant**.** Ree and Nillesen (2009:

[30] Kolasinski and Siegel (2010) explain why saturation effects might not be economically relevant in certain contexts. They particularly show that, under general conditions, the saturation effect guarantees that the Ai and Norton measure of interaction will have the opposite sign from the interaction term coefficient, as one or more of the covariates take on extreme values.

306–307) also emphasise that 'the probit/logit and LPM often produce rather similar outcomes because the conditional distribution function tends to 'look' rather linear around its expected value, while at the same time, most draws from any conditional distribution are 'close' to the expected value'. On the other side, Horrace and Oaxaca (2006) point out that OLS estimates of LPMs where the predicted probabilities are outside the unit interval, may lead to biased and inconsistent estimates. They propose the sequential least squares (SLS) procedure as a way of remedying this problem. This iterative procedure first trims from the data those OLS estimate observations with predictions lying outside the unit interval. Based on these estimations, the data are trimmed again and the model re-estimated. The procedure is repeated until no predictions are outside the unit interval and the SLS estimates are thus obtained.

In this study, the use of Horrace and Oaxaca (2006) method does not allow the convergence of the estimations' results due to insufficient number of observations. This is why we finally rely on the simple LPM based on the traditional two-stage least squares (2SLS) approach described above (see above) to perform our regressions. In fact, given the presence of many interaction variables in our model, the '2SLS approach' compared to the 'residual-inclusion approach' will permit us to not only obtain consistent parameters but also to easily correct the standard errors[31]. In cases where the R-squared (R^2) from the first-stage regression is very high, the estimated standard errors in the second-stage regression must be taken as the true estimates (see Gujarati, 1995, - Appendix 20A, Section 20A).

8.2 Interpretation of the estimations' results

In our specific case, when focusing on our two troublesome variables of interest (remittances over GDP and ODA over GDP), we obtain $R^2 = 0.94$ for the first-stage regression model of 'remittances' variable and $R^2 = 0.96$ for the first-stage regression model of "ODA" variable. As these two R^2 are very high, we will consider both the standard errors associated with parameters of these two variables and their interactions with fiscal policy variables as the true estimates.

[31]The 2SLS approach generates consistent estimates of the model parameters (when quality instrumental variables are used) but the standard errors are wrong because they are based on the predicted values of the endogenous explanatory factor. Hence, the standard errors in this manual two-stage approach could be adjusted (especially when all endogenous variables are continuous) by the use of standard formulas (see Gujarati, 1995, - Appendix 20A, Section 20A or Achen, 1986).

Accordingly, we have run full-model regressions (LPM based on 2SLS procedure) with all variables, including interaction variables but given the focus of the chapter and the need to simplify our presentation, we report here only the results of interaction variables in addition to the results of remittances and aid variables (ODA over GDP ratio and ODA Unpredictability). These results are reported in Table 4 below.

For the sake of brevity, we will interpret solely the results of the Table 4 where the coefficients, particularly those of interaction variables are statistically significant. It is also worth mentioning that irrespective of the sample considered (full sample or sub-samples), the unpredictability of aid inflows does not exert any influence on the probability of fiscal adjustment, be the latter gradual or rapid.

Consider first the full sample of developing countries (see Column 1 and 2 of the Table 4). The results in Column [1] show evidence that a rise in direct taxes (in % of GDP) in year t-1 or a diminishing of either indirect taxes (in % of GDP) or even primary spending (in % of GDP) combined with an increase in remittances in year t raise the chance of rapid fiscal adjustments (although the coefficient are significant only at 10% level). In the meantime, an increase in the unpredictability of aid inflows in year t lowers the probability of the adoption of rapid fiscal adjustment measures in countries where non-tax revenue increased in year t-1. Note that despite the inclusion of interaction variables in the model, we also observe like in the Table 2 (Column 4 and 5) the positive and negative significant effects of respectively remittances and aid (Net ODA in % of GDP) variables.

In column 2 of Table 4, the results are suggestive evidence of absence of significant effect of the remittances and aid variables on the likelihood of gradual fiscal adjustments. However, surprisingly, an increase in remittances in year t induces a higher probability of gradual adjustment in countries where direct taxes (in percent of GDP) increased the previous year. This probability appears to diminish when remittances increase in the context of trade taxes diminishing. In the meantime, the marginal impact of net aid inflows (in year t) on the likelihood of gradual fiscal adjustment decreases when the level of trade taxes in previous year went up; a higher unpredictability of aid inflows contributes to raise the probability of gradual fiscal adjustment in countries that register a rise in primary spending in the previous year.

Let us turn now to the results obtained on our two sub-samples.

Considering the sub-sample of 30 remittance-dependent economies (denoted G30remit), the results indicate that in addition to the positive significance of the additive 'remittances'

variable, only one interaction term is statistically significant in the case of rapid fiscal adjustment: the interaction between remittances (in year t) and the primary expenditures of the previous year. This means that rises in remittances are associated with lower probability of rapid fiscal adjustments in the context of higher previous year's primary spending. As regard gradual fiscal adjustment, we observe once again the positive and negative significant effects of respectively remittances and aid (Net ODA) variables. In the meantime, remittances are associated with lower probability of gradual fiscal adjustments in countries where previous year's primary spending increased. Furthermore, a rise in net aid inflows decreases the likelihood of gradual fiscal adjustment in countries where non-tax revenues of the previous year diminished.

In columns 5 and 6, the results concern the sub-sample of Low-Income Countries and lead us to conclude that:

- Except the net aid variable for the case of gradual fiscal adjustment (where a negative effect is obtained at only 10% level of significance), none of the additive variable (remittances and aid variables) is significant in explaining the probability of these countries to engage in either gradual or rapid fiscal adjustment.
- The higher the net aid inflows (in percentage of GDP), the higher the probability of LICs to engage in rapid fiscal adjustment when non-tax revenue of previous year increased.
- In LICs where direct taxes of year t-1 increased, a rise in the unpredictability of aid inflows in year t raises the likelihood of these countries to engage in gradual fiscal adjustment in year t.

9. Conclusion and Policy Implications

This chapter examines the impact of migrants' remittances and the unpredictability of aid flows on the inclination of governments in developing countries to adopt fiscal adjustment measures. The study is conducted over the period of 1980–2007 and starts from a sample of 74 developing countries which is reduced (during estimations) to 55 countries because of data unavailability. We also perform the analysis on two sub-samples: low-income countries and the group of the top 30 remittance-dependent countries of our sample. After controlling for several variables in a conditional logit model and using (old) instrumental variables approaches to mitigate the possible endogeneity bias for several explanatory variables, our results suggest that workers' remittances increase the likelihood of fiscal consolidation, be the

latter gradual or rapid. This result remains valid for the two different sub-samples analysed in this chapter, except for low-income countries, for which we observe no effect of remittances on the decision to consolidate the budget gradually. However, whatever the sample considered, some interactions of the 'remittances' variable with some of our fiscal policy variables are statistically significant while others are not. Hence, this positive effect of remittances (irrespective of the sample considered) seems to have sometimes translated through fiscal policy variables. Overall, this result suggests that despite the well-known positive macroeconomic effects of remittances, the rise of the latter appears to lead governments' recipients in developing countries to adopt fiscal profligacy measures and to consolidate their budgets further. Better management of the revenues derived from these private transfers during their booms could help avoid such situations and allow greater room for manoeuvre for governments' recipients to implement countercyclical measures during bad times.

Furthermore, we find evidence that the unpredictability of aid inflows does not affect the adoption of fiscal consolidation measures in all the groups considered. The explanation can be rooted in either the utilization of such aid by the recipient countries that makes unaffected the government's budget, or because we control for the quality of governance variable. However, even if aid unpredictability does not seem to affect here the inclination of recipient countries to adopt fiscal retrenchment measures, it remains that unexpected aid shortfalls or rises can affect other macroeconomic variables (for e.g., on inflation and real exchange rate) and consequently threaten the macroeconomic stability of the recipient country. Obviously, this is not the topic of our study here.

Table 3: The Impact of Aid Unpredictability and Migrants' Remittances on Fiscal Consolidation – The Sub-samples of top 30 Remittance-dependent Countries and Low Income Countries (LICs).

The Model is based on Residuals inclusion method for Instrumentation.

	G30remit		*LICs*			
	'FCAlesina'	*'FCHeylen'*	*'FCAlesina'*			*'FCHeylen'*[a]
Regressors	(1)	(2)	(3)		Regressors	(4)
Log(Remit)	1.009***	2.061***	3.349**		Predicted (Log(Remit))	1.877
	(0.372)	(0.596)	(1.657)			(1.482)
Unpredictability	-0.224	0.138	0.0528		Unpredictability	-0.437
	(0.170)	(0.164)	(0.194)			(0.270)
Log(Net ODA)	-1.076	-4.444***	-2.239		Predicted (Log(Net ODA))	2.432
	(0.777)	(1.308)	(3.148)			(3.853)
$Nontaxrevenuegdp_{t-1}$	-0.0715	-0.334**	-0.817		$Nontaxrevenuegdp_{t-1}$	-2.018*
	(0.101)	(0.133)	(0.628)			(1.030)
$Directtaxesgdp_{t-1}$	-0.452	0.0482	0.286		$Directtaxesgdp_{t-1}$	1.058
	(0.340)	(0.362)	(0.548)			(0.937)
$Vatexcisesgdp_{t-1}$	-0.167	-0.172	0.0397		$Vatexcisesgdp_{t-1}$	-0.0763
	(0.183)	(0.237)	(0.796)			(1.078)
$Tradetaxesgdp_{t-1}$	0.0930	-0.248	-0.17		$Tradetaxesgdp_{t-1}$	-0.335
	(0.517)	(0.367)	(0.49)			(0.666)
$Primaryexpendgdp_{t-1}$	0.0458	0.442*	0.544**		$Primaryexpendgdp_{t-1}$	0.834**
	(0.208)	(0.231)	(0.254)			(0.405)
Domesticdebtgdp	0.0743	0.0489	0.306*		Predicted (Domesticdebtgdp)	0.0453
	(0.0869)	(0.0593)	(0.162)			(0.193)
Capitalflightgdp	-0.00040	0.00247	-0.0116		Predicted (Capitalflightgdp)	0.0145
	(0.0016)	(0.00240)	(0.0094)			(0.0124)
Outputgap	-4.67e-11	4.81e-10**	-6.50e-10		Predicted (Output_gap)	-2.61e-10
	(1.25e-10)	(1.94e-10)	(2.05e-09)			(1.73e-09)
Inflation	0.0452	-0.0401	-0.035		Predicted (Inflation)	0.114
	(0.0433)	(0.0534)	(0.123)			(0.163)
$GDPGrowth_{t-1}$	0.203	-0.0314	0.313*		$GDPGrowth_{t-1}$	0.19
	(0.143)	(0.156)	(0.176)			(0.231)
Log(REER)	-2.723	-12.76***	-13.10**		Predicted (Log(REER))	-3.053

	(1.917)	(3.583)	(5.426)			(6.35)
IMF	1.531	1.104	5.317**		IMF	0.363
	(0.947)	(1.135)	(2.582)			(3.236)
Qog	3.896	-3.457	-2.995		Qog	-14.25
	(4.773)	(6.476)	(7.609)			(17.74)
NumberfcAlesina/Heylen	-1.26***	-5.068***	-1.763**		NumberfcAlesina/Heylen	-6.131***
	(0.357)	(0.835)	(0.826)			(2.128)
VariablefcAlesina/Heylen	-0.176	-0.695***	-0.21		VariablefcAlesina/Heylen	-1.106**
	(0.141)	(0.19)	(0.441)			(0.482)
Spline1	0.00209	-0.0045	-0.0043		Spline1	-0.000201
	(0.0029)	(0.0028)	(0.0128)			(0.0111)
Spline2	-0.0103	-0.004	-0.0268		Spline2	0.0139
	(0.0082)	(0.012)	(0.0317)			(0.0541)
Spline3	0.00679	0.00042	0.0228		Spline3	-0.0118
	(0.0089)	(0.0128)	(0.0388)			(0.0604)
Test on Spline1	0.51 (0.474)	2.54 (0.111)	0.11 (0.7377)		Test on Spline1	0.00 (0.9856)
Test on Spline2	1.56 (0.211)	0.11 (0.741)	0.71 (0.3988)		Test on Spline2	0.07 (0.7971)
Test on Spline3	0.59 (0.44)	0.00 (0.974)	0.35 (0.5569)		Test on Spline3	0.04 (0.845)
Test on variable	1.55 (0.213)	13.36 (0.0003)	0.23 (0.6347)		Test on variable	5.27 (0.0217)
Joint F-test on ‘duration	3.82 (0.431)	18.33 (0.001)	1.01 (0.9076)		Joint F-test on ‘duration dependence’ variables	8.42 (0.0773)
LR	78.01 (0.0000)	193.89	60.71 (0.0003)		LR	92.52 (0.0000)
Log-likelihood	-96.423761	-58.865986	-27.154335		Log-likelihood	-16.310218
Countries–observations	23-334	21-317	11-122		Countries–observations	9-118

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01.

a: The results stem from the Instrumental Variable (IV) model based on the predicted values of the troublesome explanatory variables because the results of the IV model based on the residual inclusion do not converge for the LICs sub-sample due to insufficient data.

G30remit = Group of Top 30 Dependent Remittances Countries (Average over the period 1980-2007) of our sample.

Note also that for sake of brevity, we do not report the results obtained for residual stemming from the first stage of instrumental variable model in the case of the residual-inclusion based approach. These results could be obtained upon request.

Table 4: The Impact of Aid Unpredictability and Migrants' Remittances on Fiscal Consolidation
The estimations rely on the Linear Probability Model (LPM) based on Two-Stage Least Squares (2SLS) Approach

	Model with the Instrumental Variables: The Predicted Values of some troublesome explanatory variables					
	Full sample of developing countries		*G30remit*		*LICs*	
	'FCAlesina'	*'FCHeylen'*	*'FCAlesina'*	*'FCHeylen'*	*'FCAlesina'*	*'FCHeylen'*
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Regressors						
Predicted (Log(Remit))	**0.276*** **	0.166	**0.445** **	**0.306** **	-0.00932	-0.190
	(0.0962)	(0.101)	**(0.173)**	**(0.128)**	(0.267)	(0.210)
Unpredictability	0.0371	-0.0114	-0.0369	-0.0183	-0.0310	0.00909
	(0.0297)	(0.0285)	(0.0367)	(0.0393)	(0.0773)	(0.0527)
Predicted (Log(Net ODA))	**-0.361** **	0.0952	-0.165	**-0.464***	-0.501	**-0.874***
	(0.165)	(0.224)	(0.282)	**(0.260)**	(0.581)	**(0.477)**
Predicted (Log(Remit))*Directtaxesgdp$_{t-1}$	**0.00821***	**0.00728***	-0.0147	-0.0313	0.00761	0.00792
	(0.00422)	**(0.00376)**	(0.0322)	(0.0284)	(0.0546)	(0.0461)
Predicted (Log(Remit))*Vatexcisesgdp$_{t-1}$	**-0.0129***	-0.00705	0.00500	0.0131	-0.0147	0.0383
	(0.00749)	(0.00711)	(0.0172)	(0.0148)	(0.0437)	(0.0342)
Predicted (Log(Remit))*Tradetaxesgdp$_{t-1}$	-0.00463	**-0.0202** **	-0.0112	0.0237	-0.0421	-0.0114
	(0.0111)	**(0.00970)**	(0.0345)	(0.0217)	(0.0245)	(0.0231)
Predicted (Log(Remit))*Nontaxrevenuegdp$_{t-1}$	0.00250	0.000768	-0.00115	0.00484	0.00702	0.00973
	(0.00449)	(0.00340)	(0.00883)	(0.00618)	(0.0279)	(0.0260)
Predicted (Log(Remit))*Primaryexpendgdp$_{t-1}$	**-0.00588***	0.000546	**-0.0199** **	**-0.0180** **	0.0119	0.00579
	(0.00350)	(0.00355)	**(0.00848)**	**(0.00798)**	(0.0100)	(0.00617)
Predicted (Log(Net ODA))*Directtaxesgdp$_{t-1}$	0.00245	-0.00288	-0.0300	-0.00874	0.0170	0.167
	(0.0106)	(0.0127)	(0.0236)	(0.0252)	(0.102)	(0.107)
Predicted (Log(Net ODA))*Vatexcisesgdp$_{t-1}$	0.0152	-0.0120	0.0118	-0.0123	0.0564	0.0832
	(0.0111)	(0.0111)	(0.0182)	(0.0222)	(0.0758)	(0.0686)
Predicted (Log(Net ODA))*Tradetaxesgdp$_{t-1}$	-0.00580	**-0.0376*** **	-0.0200	-0.00961	-0.0645	-0.139
	(0.0121)	**(0.0126)**	(0.0234)	(0.0267)	(0.105)	(0.101)
Predicted (Log(Net ODA))*Nontaxrevenuegdp$_{t-1}$	-0.00287	-0.00823	0.00993	**0.0179***	**0.157***	0.129
	(0.00679)	(0.00831)	(0.00987)	**(0.00896)**	**(0.0759)**	(0.0829)
Predicted (Log(Net ODA))*Primaryexpendgdp$_{t-1}$	-4.91e-05	-0.00618	-0.00150	0.00263	-0.0169	-0.000288
	(0.00449)	(0.00559)	(0.00821)	(0.00761)	(0.0163)	(0.0217)
Unpredictability*Directtaxesgdp$_{t-1}$	-0.000233	0.00391	0.00756	0.00549	**0.0120***	-0.00123
	(0.00386)	(0.00277)	(0.00553)	(0.00530)	**(0.00664)**	(0.00703)
Unpredictability*Vatexcisesgdp$_{t-1}$	-0.000545	0.000949	0.00136	0.000702	-0.00671	-0.000569

	(0.00163)	(0.00200)	(0.00184)	(0.00207)	(0.00439)	(0.00450)
Unpredictability*Tradetaxesgdp$_{t-1}$	0.000399	-0.000643	-0.00148	-0.00249	-0.00118	0.00374
	(0.00283)	(0.00279)	(0.00441)	(0.00453)	(0.0113)	(0.00756)
Unpredictability*Nontaxrevenuegdp$_{t-1}$	**-0.00188****	-0.000839	-0.00122	-0.000672	-0.000232	-0.000587
	(0.000729)	(0.000699)	(0.00102)	(0.000952)	(0.00112)	(0.00115)
Unpredictability*Primaryexpendgdp$_{t-1}$	0.000704	**0.00181***	0.00222	-0.000560	-0.00751	-0.00440
	(0.000826)	**(0.00102)**	(0.00155)	(0.00177)	(0.00828)	(0.00656)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis.
Although we have run the full model regression, we present here only the results of our variables of interest, namely the results of interaction variables in addition to the results of remittances and aid variables (ODA over GDP ratio and Aid Unpredictability).

Appendices and Tables

Appendix1: The Periods of Fiscal Adjustments in developing countries

Country	Rapid Adjustments	Gradual Adjustments
Albania	94-95; 98-00; 03;05-06	94-95; 98-00; 02-07
Algeria	91 ; 95-96 ; 99-00 ; 03 ; 05-06	94-97 ; 99-00 ; 05-06
Argentina	86 ; 90-91; 96 ; 01 ; 03-04	90-91 ; 00-01 ; 03-05
Armenia	96 ; 98-99 ; 01-02 ; 07	98-99 ; 01-02
Bangladesh	89	-
Belarus	96-97 ; 01 ; 03-07	96-97 ; 01-07
Bolivia	85-86 ; 90 ; 04-06	85-86 ; 89-92 ; 94-95 ; 97-98 ; 04-06
Botswana	82-85 ; 88 ; 90 ; 95-96 ; 00 ; 06	82-85 ; 95-96 ; 05-06
Brazil	81 ; 83 ; 85 ; 87 ; 89-90 ; 92-94 ; 98	81-83 ; 89-90 ; 92-95 ; 98-02
Burkina Faso	84-85 ; 90-91 ; 96-97 ; 99 ; 03 ; 07	84-85 ; 90-91 ; 95-99 ; 06-07
Cameroon	81-84 ; 94-96 ; 00 ; 05-06	81-84 ; 94-96 ; 05-06
Chile	84 ; 95 ; 00 ; 04-07	00-01 ; 04-07
China	94-95 ; 97 ; 00 ; 06-07	94-95 ; 97-98 ; 00-07
Colombia	85 ; 01 ; 04-05	85-87 ; 99-02 ; 04-07
Congo, Rep.	85 ; 89-90 ; 93-94 ; 96 ; 99-01 ; 03-06	84-85 ; 88-90 ; 93-94 ; 99-01 ; 03-06
Costa Rica	83 ; 92 ; 99 ; 06-07	91-93 ; 97-99 ; 05-07
Cote d'Ivoire	81 ; 83-85 ; 90 ; 94 ; 04	81-85 ; 90-91 ; 03-04
Dominican Republic	85-86 ; 88 ; 92 ; 97	85-88 ; 00-01
Ecuador	82 ; 84-85 ; 89-90 ; 95 ; 99-00 ; 04 ; 06	84-85 ; 88-90 ; 99-00 ; 06-07
Egypt, Arab Rep.	81-83 ; 91-92 ; 05-06	81-83 ; 91-92 ; 04-06
El Salvador	92-93 ; 01 ; 03 ; 06	91-95 ; 99-03 ; 06-07
Ethiopia	84-85 ; 92 ; 95 ; 01 ; 04 ; 06	83-86 ; 91-92 ; 95-97 ; 04-06
Gabon	81-82 ; 89 ; 91 ; 94-95 ; 97 ; 99 ; 01 ; 05	81-82 ; 94-95 ; 05-06
Gambia, The	82 ; 84 ; 86 ; 94 ; 98 ; 02-04	85-86 ; 91-92 ; 02-04
Ghana	84 ; 86 ; 91 ; 93 ; 95 ; 02-03 ; 05	82-88 ; 02-03
Guatemala	91 ; 95 ; 98 ; 06	91-92 ; 95-96

Guinea	81-82 ; 87 ; 05	81-82 ; 04-05
Guinea-Bissau	81 ; 87 ; 90 ; 94 ; 96 ; 99 ; 03 ; 06	84-87 ; 93-94 ; 03-06
Haiti	95 ; 97-98 ; 04	97-99 ; 03-04
Honduras	95	94-95
India	93-94 ; 03 ; 05	91-94 ; 00-05
Indonesia	98 ; 05	93-98 ; 04-05
Iran, Islamic Rep.	81-82 ; 87 ; 89-90 ; 96 ; 99 ; 02 ; 05	81-82 ; 89-90 ; 95-96 ; 02-03
Jamaica	81 ; 84-85 ; 95 ; 99-00 ; 07	84-85 ; 99-00
Jordan	82-83 ; 85-86 ; 88-92 ; 95 ; 04-06	82-83 ; 85-86 ; 88-92 ; 04-07
Kazakhstan	97-98 ; 00 ; 03 ; 05 ; 07	97-00 ; 05-07
Kenya	88 ; 93 ; 04 ; 06	86-89
Lebanon	02-03	01-03
Liberia	83 ; 88 ; 02-04 ; 06-07	81-84 ; 02-04 ; 06-07
Madagascar	84 ; 86-87 ; 97 ; 99 ; 04 ; 06	86-87 ; 96-99
Malawi	84 ; 90 ; 98 ; 04-05	84-85 ; 89-90 ; 04-05
Malaysia	01	96-97
Maldives	81-82 ; 87 ; 94-95 ; 06-07	81-83 ; 87-89 ; 94-95 ; 01-03 ; 06-07
Mali	82 ; 86 ; 89-90 ; 92 ; 96 ; 99	86-87 ; 89-90 ; 96-97 ; 01-02
Mexico	81-83	81-83
Moldova	97-00 ; 03-04 ; 06	97-00 ; 03-06
Mongolia	93 ; 95 ; 97 ; 99-01 ; 06-07	99-03 ; 06-07
Morocco	88 ; 92 ; 96 ; 01 ; 06-07	87-89 ; 96-98 ; 06-07
Mozambique	95 ; 05 ; 07	95-96
Namibia	83-85 ; 87 ; 89 ; 91 ; 96-97 ; 02 ; 04 ; 06	83-87 ; 96-97 ; 04-06
Nicaragua	91 ; 94 ; 97-98	93-98 ; 03-05
Niger	84 ; 93 ; 95 ; 98 ; 01-02 ; 06	95-98 ; 01-02 ; 06-07
Nigeria	89-90 ; 92 ; 95 ; 99-01 ; 05	89-90 ; 99-01
Pakistan	89 ; 93	89-90
Panama	91-92 ; 99 ; 01 ; 03 ; 06	91-92 ; 06-07
Papua New Guinea	82-84 ; 86-87 ; 94-95 ; 97 ; 04 ; 06	82-84 ; 86-87 ; 93-95

Paraguay	95 ; 01 ; 03-04	97-99 ; 03-04
Peru	84 ; 88 ; 90-91 ; 93 ; 96 ; 06-07	84-85 ; 90-93 ; 95-96 ; 02-07
Philippines	94	91-94
Senegal	07	94-96 ; 00-02 ; 06-07
South Africa	95 ; 05	95-96 ; 04-07
Sri Lanka	83-84 ; 89	83-84 ; 89-90 ; 92-93 ; 01-03
Sudan	81 ; 83 ; 87 ; 92 ; 97-00 ; 04	97-00
Tanzania	87 ; 89-91 ; 93-96 ; 07	89-91 ; 93-96
Thailand	03	-
Togo	82-85 ; 88 ; 94-95 ; 97 ; 01 ; 03 ; 06-07	82-85 ; 94-97 ; 01-03 ; 06-07
Tunisia	82 ; 84 ; 93	82-82 ; 91-94
Uganda	82-83 ; 88 ; 91 ; 94	82-83 ; 91-94
Uruguay	92-93 ; 97 ; 04 ; 06	91-93 ; 96-98
Venezuela, RB	94 ; 96-97 ; 99	96-97
Vietnam	04	88-02
Yemen, Rep.	91 ; 95-97 ; 99-00 ; 04-06	95-97 ; 99-00 ; 03-06
Zambia	83 ; 85-86 ; 90 ; 93-95 ; 99-00	85-87 ; 93-95 ; 98-00
Zimbabwe	81-83 ; 89 ; 96-98 ; 03-04	81-83 ; 96-98 ; 03-04

Appendix 2: Variables - Definitions and sources

Variable	Definition	Source	Comments
Wrgdp	Workers' remittances, receipts (% of GDP).	World Bank Development Indicators – WBDI (2010).	Workers' remittances record current transfers by migrants who are employed in, and considered a resident of, the countries that host them.
Unpredictability	Unpredictability of development aid inflows	Author's calculation based on Official Development Assistance (ODA) variables.	For the computation of this variable in reference to Levy (1988); see section 6.
FCAlesina	Episodes of large (rapid) tight Fiscal Policy.	Author's Calculation using data from World Bank Development Indicators – WBDI (2010), Government Development Finance (GDF) – 2010 and Alesina and Ardagna (2010)'s definition of "fiscal consolidation episode".	For this variable, we use the definition of "fiscal consolidation episode" of Alesina and Ardagna (2010). These calculations are based on total government revenue (excluding grants), expenditure, interests payments on government's debt and GDP data. The total government revenue and government's spending stem from CERDI's database. The interest payments on external debt stem from the Government Development Finance (GDF) – 2010. The source of the GDP is the WDI 2010.
FCHeylen	Episodes of gradual tight Fiscal Policy.	Author's Calculation using data from World Bank Development Indicators – WBDI (2010), Government Development Finance (GDF) – 2010 and Heylen and Everaert (2000)'s definition of "fiscal consolidation episode".	For this variable, we use the definition of "fiscal consolidation episode" of Heylen and Everaert (2000). These calculations are based on total government revenue (excluding grants), expenditure, interests payments on government's debt and GDP data. The total government revenue and government's spending stem from CERDI's database. The interest payments on external debt stem from the Government Development Finance (GDF) – 2010. The source of the GDP is the WDI 2010.

Outputgap	Output Gap	Author's Calculation using data from World Bank Development Indicators – WBDI (2010).	The Output Gap is calculated as the difference between the actual output and the potential output. The actual output is the Gross Domestic Product (GDP), PPP, (constant 2005 international $) of WDI 2010 and the potential output is computed by the use of the Hodrick Prescott Filter (with lambda = 100).
Inflation	Inflation (annual %)	Author's calculation using Inflation, consumer prices (annual %) from WBDI (2010) and Inflation, GDP deflator (annual %) also from WBDI (2010).	This variable is the inflation (Consumer prices, %) where we replace the missing data by those of the Inflation (Deflator GDP, %).
GDPGrowth	Growth of GDP (annual %)	WBDI 2010	We use the GDP (based on PPP 2005 Constant 2005 International $) to compute the GDP growth rate (annual %).
REER	Real Effective Exchange Rate.	Database of CERDI (Centre d'Etudes et de Recherches sur le Developpement International) - France	This is the Real Effective Exchange Rate, base 2005 = 100 computed by CERDI.: it is the ratio of prices in the country to prices in the main import partners adjusted for variations in nominal effective exchange rate. An increase means an appreciation.
IMF	IMF Programmes	Database of CERDI and IMF's annual reports, various years.	Dummy Variable that takes the value "1" (the value "0", otherwise) if the country is under agreement with the IMF in the previous fiscal year. IMF programs considered here are non-crisis programs: Standby Credit Facility (SCF), Extended Credit Facility (ECF), Structural Adjustment Facility (SAF), Enhanced Structural Adjustment Facility (ESAF) and Poverty Reduction and Growth Facility (PRGF).
Odanetdisbgdp	ODA Total, Net disbursements - in % of GDP	Author's calculation using data from OECD.Stat DAC dataset and the WBDI 2010.	We use the Total Net disbursements of ODA in US current Dollars (source: OECD.Stat DAC dataset) that we divide by the GDP in US current Dollars (source: WDI 2010).

Nontaxrevenuegdp	Non Tax Revenue, in % of GDP	CERDI's Database of Government Revenues (in % of GDP)	This is the first component of the overall tax revenue (excluding grants).
Directtaxesgdp	Direct Taxes, in % of GDP	CERDI's Database of Government Revenues (in % of GDP)	This is the second component of the overall tax revenue (excluding grants).
Vatexcisesgdp	Value Added and Excises Taxes, in % of	CERDI's Database of Government Revenues (in % of GDP)	This is the third component of the overall tax revenue (excluding grants).
Tradetaxesgdp	Trade Taxes, in % of GDP	CERDI's Database of Government Revenues (in % of GDP)	This is the fourth and last component of the overall tax revenue (excluding grants).
Primaryexpendituresgdp	Primary Expenditures, in % of GDP	Author's calculation using several sources of data: CERDI's Database for Government Revenues (in % of GDP) and government expenditures (in % of GDP) and the GDF (2010) for interest payments on government debt (in % of GDP).	The Primary expenditure is computed for each country as follows: Primary Expenditure = Expenditure (in % of GDP) minus Interest payments on government debt (in % of GDP).
Capitalflightgdp	Capital Flight, in % of GDP	Author's calculation using WDI (2010) data.	The capital flight, in % of GDP is computed as follows: Capitalflightgdp = [change in external debt in % of GDP + Foreign Direct Investment (net inflows) in % of GDP + Current account in % of GDP + change in net reserves in % of GDP]*100.
Domesticdebtgdp	Domestic debt, in % of GDP	Author's calculation using several sources of data: the Historical Public Debt Database of IMF [which can be found at: http://www.imf.org/external/ns/cs.aspx?id=262.] for the Gros Public Debt in % of GDP and the WBDI 2010 for external debt, in % of GDP data.	The domestic debt in % of GDP is computed as follows: Domesticdebtgdp = Gross Public Debt in % of GDP minus External debt (in % of GDP).
NumberfcAlesina	Number of prior adjustments using "FCAlesina"	Calculation of the Author by focusing on the variable "FCAlesina"	For instance, if there is a continuous adjustment over 4 consecutive years, it is considered as 1 adjustment.
Numberfcheylen	Number of prior adjustments using "FCHeylen"	Calculation of the Author by focusing on the variable "FCHeylen".	For instance, if there is a continuous adjustment over 4 consecutive years, it is considered as 1 adjustment.
VariablefcAlesina	Time since previous Adjustment for "FCAlesina"	Author's calculation	Variable constructed by the author at the same time as the Splines variables used in our study.

VariablefcHeylen	Time since previous Adjustment for "FCHeylen"	Author's calculation	Variable constructed by the author at the same time as the Splines variables used in our study.
Qog	The Quality of Governance	The quality of governance is measured by subjective indices from the International Country Risk Guide (ICRG). The quality-of-governance index from ICRG used here is an 18-point scale, created by summing the following three six-point scales: corruption in government, bureaucratic quality, and the rule of law. See the ICRG for the criteria used in coding these measures. The rationale for corruption and bureaucratic quality is obvious. The rule-of-law definition indicates that this measure reflects the government's administrative capacity in enforcing the law, as well as the potential for rent-seeking associated with weak legal systems and insecure property rights. Source: International Country Risk Guide (ICRG) Data.	As mentioned in the section 4, to avoid the endogeneity of this variable stemming from the simultaneity between the fiscal adjustment variable and the quality of governance, the latter is transformed by taking the average value of the past three years (not counting the current year).

Appendix 3: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Wrgdp	1482	3.026585	4.851511	0	31.03261
Unpredictability	1768	-0.08782	5.102131	-56.24728	41.44596
Odanetdisbgdp	1932	6.875867	10.1976	-.6928778	108.325
Nontaxrevenuegdp	1317	6.540749	6.376471	-1.91e-06	51.67495
Directtaxesgdp	1350	4.776211	3.997292	0.1503	28.67735
Vatexcisesgdp	1579	5.815693	3.180165	0	21.96181
Tradetaxesgdp	1563	3.598655	2.682772	0	18.13286
Primaryexpendituresgdp	1868	15.95348	8.787456	-1.026296	64.03642
Domesticdebtgdp	1812	2.967178	47.99027	-681.1356	1027.918
Capitalflightgdp	1717	213.5482	298.0549	-1196.991	3432.027
Outputgap	1966	1.78e+08	1.75e+10	-1.80e+11	4.82e+11
Inflation	1980	78.0509	758.6056	-100	24411.03
GDPGrowth	1819	3.451455	6.198314	-51.03086	106.2798
REER	1935	224.744	3775.504	29.74355	166045.4
IMF	2072	0.2784749	0.4483566	0	1
Qog	1667	0.4426812	0.1508666	0.050926	0.8734568
NumberfcAlesina	1646	2.097813	1.805303	0	10
VariablefcAlesina	1646	2.814095	3.798825	0	26
Numberfcheylen	1645	1.119149	1.045395	0	5
Variablefcheylen	1646	3.23633	4.345075	0	26

Appendix 4: List of the Sub-samples countries

Low-Income Countries (LICs) : Bangladesh; Burkina Faso; Ethiopia; Gambia, The; Guinea; Guinea-Bissau; Haiti; Kenya; Liberia; Madagascar; Malawi; Mali; Mozambique; Niger; Tanzania; Togo; Uganda; Zimbabwe.
The classification of the LICs group of countries is based on the World Bank's classification.

Group of the Top 30 Remittances-Dependent Countries: This list is obtained by averaging the data on workers' remittances over our period of study (1980-2007).

Albania Bangladesh Burkina Faso Dominican Republic Ecuador Egypt, Arab Rep; El Salvador; Gambia, The; Guatemala; Guinea-Bissau; Haiti; Honduras; Jamaica; Jordan; Kenya; Lebanon; Liberia; Mali; Moldova; Morocco; Nicaragua ; Nigeria ; Pakistan ; Senegal ; Sri Lanka ; Sudan ; Togo ; Tunisia ; Uganda ; Yemen, Rep.

PART II: STRUCTURAL VULNERABILITY AND PUBLIC INDEBTEDNESS IN DEVELOPING COUNTRIES

CHAPTER III[32]: Does Structural Economic Vulnerability Matter for Public Indebtedness in Developing Countries?

Abstract

In this study, we examine the effect of structural economic vulnerability of developing countries on their public indebtedness. We perform our econometric analysis by relying on 97 developing countries over the period 1980-2008. The results suggest evidence of a "U-shaped" relationship between the structural vulnerability and the total public debt in developing countries. In Low-Income Countries (LICs), the build-up of the total public debt is particularly explained by structural vulnerability. Accordingly, international institutions should take into account such structural vulnerability when designing development policies, especially the ones related to debt sustainability in developing countries and particularly LICs.

Keywords: Structural Vulnerability; Public debt.
JEL Classification: E60; H63; O10.

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1. Introduction

This chapter strives to explore the impact of structural vulnerability on the total public debt, especially in developing countries. The latter, through their history have been prone to several types of shocks[33] such as shocks to international commodity prices, natural disasters, conflict related shocks, global financial market shocks, shocks to international interest or exchange rates, shortfalls in external aid flows, shocks of sudden human diseases (e.g. Severe Acute Respiratory Syndrome (SARS)) which can hit tourist revenues, changes in host country policies for migrant labour, which can cut remittances (see Matthew M. and Bargawi H., 2004).

According to the World Bank classification, the developing countries group – different from that of high income countries – is heterogeneous and include low income countries (LICs), lower-middle income countries (LMICs), and upper middle income countries (UMICs), the two latter are referring to as middle income countries (MICs). While high income countries are highly exposed to market development as well as natural disaster shocks, we can distinguish two groups of developing countries in terms of vulnerability to shocks: those that have a limited access to private financing (especially the LICs and certain MICs) and those with a higher access to market-related financing. Many LICs and LMICs have in fact, benefited from the substantial debt cancellation under international schemes such as the heavily indebted poor countries (HIPCs) initiative and the multilateral debt relief initiative (MDRI). However, these initiatives provided by the Paris Club (and several other creditors) left the world developing countries at very different levels of indebtedness (UNDP, 2010). Indeed, on one side certain countries (for instance, many countries in the MICs group as well as many countries in small island developing state[34], SIDS) have not benefited from the multilateral debt relief initiatives and have managed only to reschedule bilateral credits owed to the Paris Club. As a result, these countries incur persistent and unresolved high public debt burden as measured by both stocks (solvency) and service (liquidity) indicators. On another side, many countries including in LICs, despite the debt cancellation schemes they have benefited, are engaging in rapid debt accumulation (sometimes from the domestic markets

[33] Shocks is best defined as an event which impacts on an economy and which is "exogenous" – beyond the control of the government to prevent – though, neither the unexpected nature nor the lack of government control are inevitable (see Matthew and Bargawi, 2004).

[34] The group of SIDS is a group of small open economies established by the United Nations in 2009. These countries have the particularity to be highly exposed and vulnerable to external shocks. Note that certain countries of this group belong either to the group of Low-Income Countries or to that of Middle Income Countries.

that are developed especially in sub-Saharan Africa, see Christensen, 2005; Rocher, 2007 and Cabrillac and Rocher, 2009) which give serious cause of concern.

Several studies (for e.g. Guillaumont, 2006 and UNDP, 2010) highlight that the greater vulnerability to high levels of public debt is owed to a range of structural weaknesses (that we will develop further). Many developing countries lack the required economic policies (that we will call later the "resilience") to deal adequately with such shocks and to avoid the subsequent debt accumulation. The latter associated with a high level of debt service has in turn, limited the governments' fiscal space and abilities to respond effectively to these shocks.

The rest of the chapter is structured as follows. In the next section (section 2), we will briefly present the state of the literature related to the definition and measurement of the concept of "economic vulnerability" in developing countries. From that literature review, we will also derive our preferred measure of "structural vulnerability". The section 3 will be devoted to the model of public debt accumulation that will help us examine how the latter is related to the structural vulnerability of developing countries. In section 4, we present our model specification, the discussion on the expected sign of covariates and the econometric method. In the section 5, we will expose and discuss the empirical results. The section 6 concludes and discusses the policy implications of this study.

2. The concept of 'economic vulnerability': A literature review on the definition and measurements

2.1 A literature review on the definition of 'economic vulnerability'

The concept of 'vulnerability' refers to that of 'risk'. There are several definitions associated with the concept of 'risk' depending on the disciplines where it is studied. Generally, vulnerability can be seen as the risk that a 'system' undergoes from negative change due to a 'perturbation' (see e.g. Naudé et al., 2009).

In economics, vulnerability is either associated with poverty where the concern is the risk of households falling into or remaining in poverty, or natural hazards and macro-level shocks where the concern is how the hazards adversely affect a country or region's economy (see e.g. Naudé et al., 2009). Guillaumont (2009) highlights that the first type of vulnerability can be derived from the second one. We focus in this chapter on the second kind of vulnerability: the 'economic or structural vulnerability'.

The concept of 'economic vulnerability' was defined for the first time in 1990 by the Maltese Ambassador his Excellence Mr. Alexander Borg Olivier who states that 'such an index is important because it reiterates that the per capita GDP [gross domestic product] of island developing countries is not itself an adequate measurement of the level of development of these countries as it does not reflect the structural and institutional weaknesses and the several handicaps facing island developing countries' (Maltese Government, 1990: 7). Since then many conceptual and empirical studies[35] have been conducted on the issue of economic vulnerability. More specifically, Briguglio and Kisanga (2004), Briguglio and Galea (2003), Cordina, (2004a, b) and Briguglio et al., (2008) define economic vulnerability as 'a country's proneness to exogenous shocks lying outside their control or its proneness to increased susceptibility of such a country to the adverse effects of these shocks'.

In the same vein, several studies of Patrick Guillaumont (see e.g. Guillaumont, 2009; Guillaumont and Cariolle, 2011) have been devoted to the study of 'economic vulnerability' where he defines 'the economic or structural vulnerability of a country as the risk of a (poor) country seeing its development hampered by the natural and external shocks it faces'. Thus the author considers two main types of exogenous shocks (in other words, two main sources of vulnerability):

- the environmental or 'natural' shocks which encompass, for instance, natural disasters (earthquakes, volcanic eruptions) and the more frequent climatic shocks (typhoons, hurricanes, droughts, floods, etc);
- external (trade-and-exchange-related) shocks which comprise, for instance, slumps in external demand, world commodity price instability (and correlated instability of terms of trade), international fluctuations of interest rates, and so forth.

Other domestic shocks such as unforeseen political changes are thus excluded from being exogenous.

All these studies make a distinction between the concept of 'economic vulnerability' and that of 'economic resilience'. For example, according to Briguglio et al., (2008), economic resilience refers to the policy-induced ability of an economy to recover from or adjust to the negative impact of adverse exogenous shocks and to benefit from positive shocks. Thus

[35] The conceptual and empirical viewpoints of economic vulnerability are well documented in the literature (see e.g. Atkins et al., 2000; Briguglio 1995; Briguglio and Galea, 2003). Cordiana and Farrugia (2005) also provide a summary on the measurement issue of the concept of 'economic vulnerability'.

defined, economic resilience may take the form of higher savings and investments which may occur in the wake of pronounced uncertainty and may enable small island states to achieve high levels of economic development (Cordina, 2004a,b). Guillaumont (2009) considers economic resilience as the capacity of a country to react to shocks. He highlights that this resilience depends more on current policy, is more easily reversed, and is less structural but may also comprise a structural element[36].

Briguglio and Kisanga (2003) develops the concept of the 'Singapore Paradox', according to which many small island states, in spite of their economic vulnerability, manage to generate a relatively high GDP per capita when compared to other developing countries. To explain this phenomenon, Briguglio and Galea (2003) and Briguglio and Kisanga (2004) take the case of Singapore which experiences high rates of economic growth and high GDP per capita despite its high exposure to external shocks. Thus the 'Singapore Paradox' stems from the juxtaposition of economic vulnerability and economic (nurtured) resilience, where economic vulnerability was confined to inherent features which are permanent or quasi-permanent, while economic resilience was associated with man-made measures which enable a country to withstand or bounce back from the negative effects of external shocks.

2.2 A literature review on the measurement of economic vulnerability

In line with the definitions of economic vulnerability provided above, we summarise here the different measures of that concept. The propositions of vulnerability indices have mainly focused on the quantification of the special features of the countries by relying on indicators such as economic openness, export concentration, dependence on imports of energy and peripherality. Other approaches attempt to measure vulnerability in terms of the phenomenon, namely the variability of output and similar indicators.

The first vulnerability index was proposed by Briguglio (1993) and is composed of three variables: the exposure to foreign economic conditions, insularity and remoteness, and proneness to natural disasters. This index has been the subject of several modifications in 1995, in 1997, and updated by Briguglio and Galea in 2003. Other authors such as Chander

[36] According to Guillaumont (2009) a distinction close to this three component is given in Rodrik (1999) who, in looking at the risk of social conflict in countries facing external shocks, considers the individual severity of the shocks, the depth of latent social conflict (likely to increase the impact of the shocks), and the quality of conflict management institutions.

(1996) and Wells (1996) follow the methodology adopted by Briguglio (1995) and propose a vulnerability index. Wells (1997) revised its measure of vulnerability and uses a methodology that departs from the previous ones where he relies on the idea that 'vulnerability manifested in instability in economic growth'. He then uses regression analysis to build its index. Atkins et al. (1998) also adopt the econometric analysis and show evidence that export dependency ratio, merchandise export diversification and vulnerability to natural disasters are the main determinants of economic vulnerability (measured by output volatility). Crowards (2000) also contributes to the literature by suggesting an index of economic vulnerability for developing countries which is composed of more variables than in the previous studies. In line with Wells' (1997) study, the Committee for Development Policy (CDP)[37] of the United Nations (UN) developed a composite index in order to identify the causes of vulnerability of least developed countries (LDCs). By capturing vulnerability through economic growth instability, this index is a weighted average of five variables, namely the share of manufacturing and modern services in GDP, merchandise export concentration ratio, instability of agricultural production, instability of exports of goods and services and population size. The weights are obtained through an econometric analysis where the impact of each economic indicator quoted above on economic growth is examined. All these studies convey the same message according to which small states are inherently more vulnerable. However, Gonzales (2000) criticizes these studies, arguing that they lead to considerable variations and contradictions due to the differences of the parameters and the methodologies employed by them.

Following the renewal growing concern over macroeconomic vulnerability of least developed countries and the demand of these countries to build an adequate vulnerability indicator which should be taken into account in the design of international development policies, the CDP has developed and progressively refined, after successive revisions (2003, 2006 and 2009) an economic vulnerability index which captures vulnerability caused by structural factors. The structural economic vulnerability employed in this study referred to the so-called 'retrospective Economic Vulnerability Index (EVI)' jointly calculated on an annual basis by the FERDI[38] (see Cariolle, 2011; Guillaumont and Cariolle, 2011) with the UN/United Nations Department of Economic and Social Affairs (DESA). This indicator covers 128

[37] This committee was previously called Committee for Development Planning.

[38] FERDI is the 'Fondation pour les Etudes et Recherches sur le Développement International'. The method of retrospective EVI's calculation can be found in details in Cariolle (2011) and descriptive statistical analysis on the retrospective EVI can be found in Guillaumont (2011), and Guillaumont and Cariolle (2011). This is why we do not find it useful to replicate this statistical analysis here and refer the readers to those articles.

developing countries over the period 1975–2008 (unbalanced panel data) and has the advantage of being simple, transparent and parsimonious. Moreover, several multilateral development banks are exploring whether to move from their traditional indicator to EVI for aid allocation (see Guillaumont, 2011, for more details).

The data available for our study (once we take into account all our variables – see below for the details on these variables) cover a panel of 96 developing countries over the period 1980–2008. The 'economic vulnerability' is a result of three components: (i) the size and frequency of the exogenous shocks, either observed (ex post vulnerability) or anticipated (ex ante vulnerability); (ii) exposure to shocks; and (iii) the capacity to react to shocks, or resilience. Therefore, *structural vulnerability* (that is, the EVI), which results from factors that are independent of a country's current political will is different from the *vulnerability deriving from policy*, which results from recent policy choices. In other words, an index of structural economic vulnerability is related to structural factors—not policy factors—that are beyond the present control of the country and which also influence global vulnerability, mainly through resilience (Guillaumont, 2009). This structural vulnerability index is a composite index of 'shocks' and 'exposure to shocks'; both indicators are equally weighted[39]. We display below the structure of the (retrospective) EVI where the weights of indices are in brackets.

Structure of the EVI

- Exposure Index (50%)
  - -Smallness (50%)
  - -Location Index (Remoteness) (25%)
  - -Specialization Index (Merchandise Export concentration and share of agriculture, forestry and fisheries) (25%)
- Shock Index (50%)
  - -Natural Shock Index(Homelessness due to natural disasters; instability of agriculture production) (50%)
  - -Trade Shock Index (Instability of exports of goods and services) (50%)

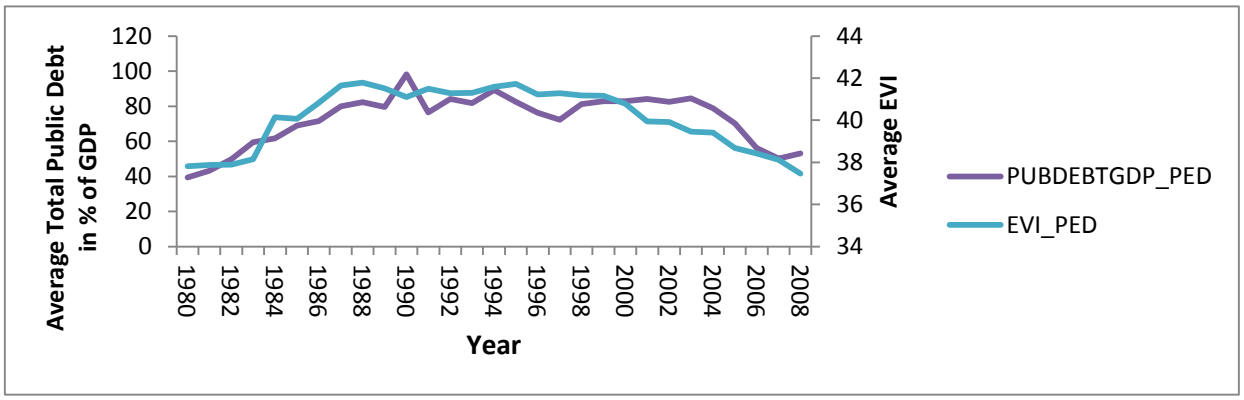
Source: Guillaumont et al. (2011)

Guillaumont (2011) concludes with regard to each of these indicators that the LDCs appear, on average, to be more vulnerable than other developing countries and even more so when

[39] See for example Guillaumont and Cariolle (2011) for a discussion on the weight of indicators.

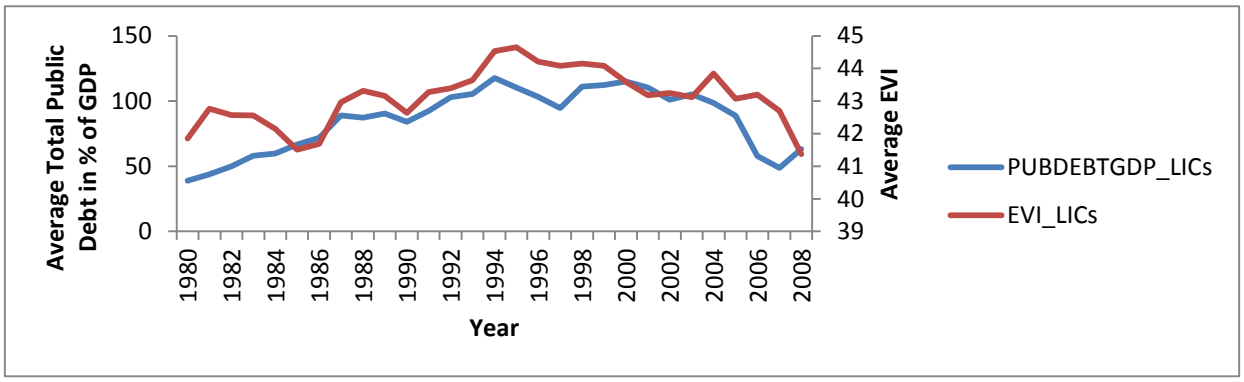
compared to other low-income countries. Figures 1–4 below compare the evolution of the average total public debt with that of the average EVI for, respectively, the developing countries and the sub-samples of the low-income countries (LICs), lower middle income countries (LMICs) and the upper middle income countries (UMICs).

Figure 1: Average Total Public debt and Average EVI of Developing Countries



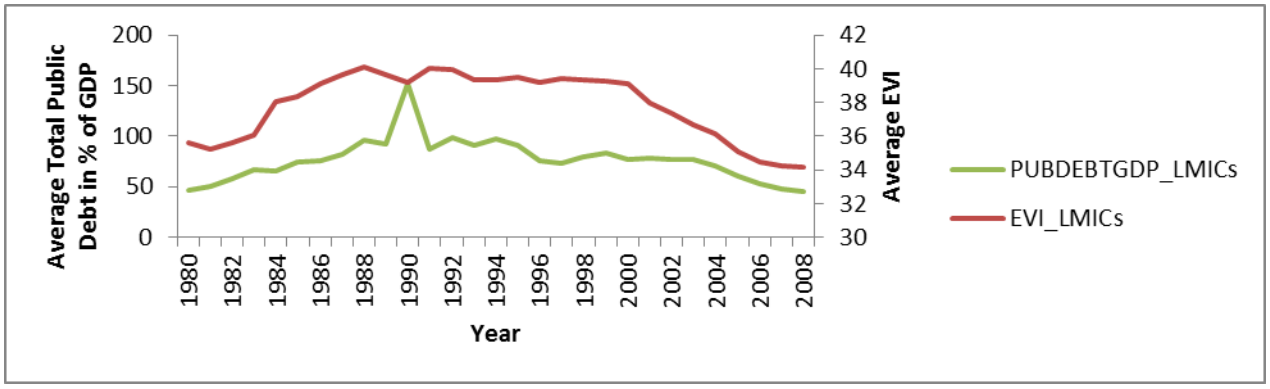
Source: Authors calculations based on data from IMF (2010) and Guillaumont and Cariolle (2011).

Figure 2: Average Total Public debt and Average EVI of Low-Income Countries (LICs)



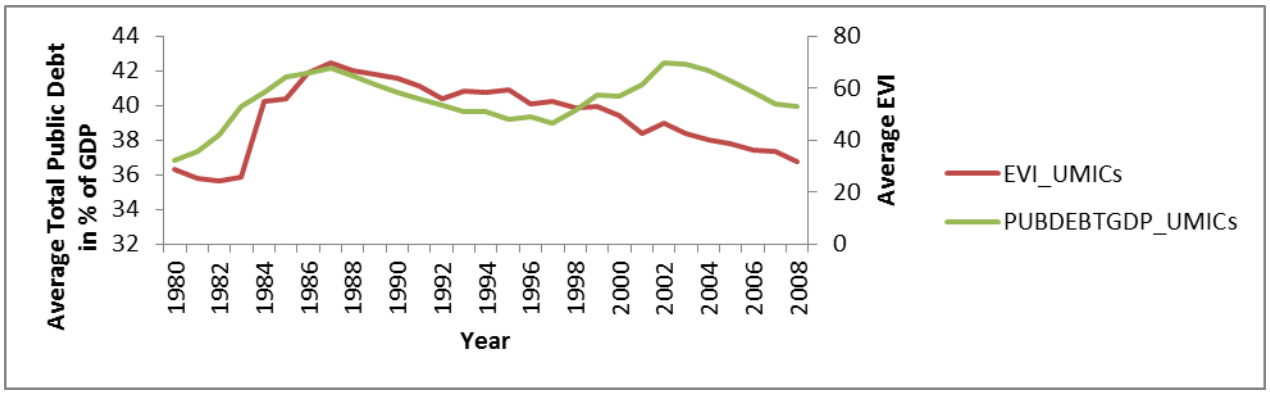
Source: Authors calculations based on data from IMF (2010) and Guillaumont and Cariolle (2011).

Figure 3: Average Total Public debt and EVI of Lower Middle Income Countries (LMICs)



Source: Authors calculations based on data from IMF (2010) and Guillaumont and Cariolle (2011).

Figure 4: Average Total Public debt and EVI of Upper Middle Income Countries (UMICs)



Source: Authors calculations based on data from IMF (2010) and Guillaumont and Cariolle (2011).

Note that we do not include the group of small island developing states (SIDS) because of the insufficiency of data on certain explanatory variables (specifically the quality of governance). However, several countries belonging to this group also pertain to one of the three sub-groups of developing countries. All these graphs suggest a strong correlation between the average EVI and the average total public debt and a co-evolution of these two variables over time.

In the next section, we expose the simple mathematical model of the public finances sustainability usually described in the literature.

3. The presentation of the simple mathematical model of the public finances sustainability

Since the purpose of our study is to examine the effect of economic vulnerability on the total public debt, we start with a public finances sustainability model and then derive the appropriate model that will help us perform our regressions.

First of all, we find useful to mention that the concept of "debt sustainability" is improperly used in the discussions of international financial and fiscal policy issues in developing countries, whereas the relevant and the best known concept is that of fiscal sustainability, that is, the sustainability of public finances. The concept of fiscal sustainability refers to the fact that governments cannot maintain indefinitely the same set of policies (for e.g. expenditures and taxes policies) and remain simultaneously solvent. This means in other words that fiscal sustainability analysis is often not on defaulting itself – which governments try to avoid – but on the consequences of the policy changes needed to prevent defaulting (Vera, 2009).

Despite the old debate on that concept (it dated from more than a century now), there is no agreed definition on what constitutes a fiscal sustainable position. In fact, there are several methods proposed by the literature to assess the fiscal sustainability, depending on the time horizons (short, medium, or long term) and the variables considered.

In theory, the study of fiscal sustainability rests on the government's budget constraint which requires that current spending on goods and services plus the costs of servicing current debt equals current tax revenues plus the issuance of new debt. Thus, the debt financing from a long-term perspective is defined with respect to two main approaches (Cuddington, 1996):

The first approach is the so-called "accounting" or Domar's approach. It is also named the borrower based approach and is defined on the basis of the static government's budget constraint. The latter is satisfied if the public sector is able to finance its current expenditures with its revenues and new borrowing, and meet or roll over its maturing liabilities; that is, if it is not liquidity-constrained.

The second approach is the solvency criterion of government finances or the Present- Value Constraint (PVC) approach, also called the lender based approach. This approach relies on the intertemporal budget constraint which requires that the present discounted value of future primary budget balances should at least be equal to the outstanding stock of debt. Thus, the public sector cannot be a debtor and the private sector cannot be a creditor, in present value terms, any debt incurred should eventually be fully repayable. If there is debt at present, the

primary balance should become positive at some date in the future in order for the present-value budget constraint to be respected.

Irrespective of the conceptual approach adopted, the fundamental block of the fiscal sustainability corresponds to a simplification of the government budget constraint (Vera, 2009). We rely in this chapter on the mathematical model of fiscal sustainability underlying that fundamental block, to estimate the effect of structural economic vulnerability on public debt in developing countries.

We assume first that the government finances its deficit only by issuing debt. Hence, we exclude for the moment other financing items such as seigniorage revenue, privatization proceeds, and the sales of public assets.

Let us denote B_t the stock of the public debt at the end of the year t; i_t the nominal interest rate on total public debt; G_t and T_t be respectively the total tax revenue and the total government consumption (excluding interest payments on the total public debt).

The government budget constraint is given by:

Debt in period t = (Debt in period t-1) + (Primary Deficit +Interest Payments on public debt) or Debt in period t - (Debt in period t-1) = Primary Deficit +Interest Payments on public debt = Primary Deficit (in year t) + i_t *(Debt for period t-1).

This equation can be rewritten as: $(B_t - B_{t-1}) = (G_t - T_t + r_t B_{t-1})$ **(1)**

To analyze the evolution of the total public debt, we need to normalize the public debt by some measure of the country's ability to service and repay its debt: the most common choice is typically the nominal Gross Domestic Product, denoted Y_t. Thus, the evolution of the debt-to-GDP ratio could be obtained by analyzing derivative of $\frac{B_t}{Y_t}$: $\Delta(\frac{B_t}{Y_t}) = \frac{\Delta B_t}{Y_t} - \frac{B_t}{Y_t}\frac{\Delta Y_t}{Y_t}$ **(2)**

If we call $b_t = \frac{B_t}{Y_t} = \frac{B_t}{p_t y_t}$ and apply $\frac{\Delta Y_t}{Y_{t-1}} = g_t + \pi_t(1+g_t)$ and $\pi_t g_t \approx 0$, the expression **(2)** can be rewritten as $\Delta b_t = \frac{\Delta B_t}{Y_t} - b_t(\pi_t + g_t)$ **(3)**,

where π_t stands for the rate of inflation and g_t for real GDP growth. The substitution of (3) into (2) leads to: $\Delta b_t = \frac{G_t - T_t + rB_{t-1}}{Y_t} - b_t(\pi_t + g_t)$ **(4)**

By defining $\phi = \frac{G_t}{p_t y_t}$, and $\tau = \frac{T_t}{p_t y_t}$, then we obtain in terms of ratios to GDP:

$$\Delta b_t = (\phi - \tau) + \frac{rB_{t-1}}{p_t y_t} - b_t(\pi_t + g_t) \quad \textbf{(5)}$$

If we assume that the debt ratios are steady state and that the real rate of interest on debt is defined by $i = r - \pi$, the rearrangement of (5) leads to: $\Delta b_t = (i - g)b_{t-1} - (\tau - \phi)$ **(6)**

The equation (6) shows that if the primary surplus ratio is equal to zero, the debt-to-GDP ratio will grow or shrink at the rate $(i - g)$, within a framework where it is assumed that there is a level beyond which the debt-to GDP-ratio cannot or should not rise. Under this situation, the public debt ratio increases when the real effective interest rate on government debt exceeds the growth rate of GDP (that is, when the growth-adjusted real effective rate is positive) unless there is a sufficient amount of primary budget surplus. In other terms, the Domar's condition for debt stability (and thus fiscal sustainability) can be held when the real GDP growth rate is higher than the real interest rate, even if the primary balance continues to be just zero.

4. The model specification, the discussion of the expected effects of covariates and the econometric technique

4.1 The model specification

When developing the previous model of fiscal sustainability, we assume that the budget deficit is financed only by debt creation. However, other financing items (such as those mentioned above) should be considered. For example, in developing countries, governments usually resort to the monetisation of deficit (the seigniorage); they can also use public investment to stimulate private investment or use it as a countercyclical tool and thus obtain revenues if the expected rate of return of the development projects related to public investment exceeds the cost of borrowing. In addition, the significant assets (buildings, mineral deposits and various forms of liquid reserves) held by governments in developing countries could provide them with substantial revenue, the latter being possibly used to alleviate the burden of public debt of these countries.

To take into account such items (at least partially) in the equation (6), we define the primary balance not as the difference between tax revenue and the government spending, but rather as the difference between the overall government revenue and excluding grants —with these

revenue comprising several items, including other non-tax revenue— and non interest (primary) expenditure.

Overall, from the equation (6) and based on the discussion made above, the fiscal sustainability depends upon the following factors:

- the primary surplus; that is, the difference between the overall government revenue including seigniorage and other types of revenues and excluding grants, and the non-interest (primary) expenditure;
- the growth of real GDP;
- the real interest rate.

We take into account these elements and further augment the model with our variables of interest (the EVI or its components and/or as we will see later, their square values), as well as other control variables which are likely to influence both the variables of interest and the dependent variable (the overall public debt).

In fact, we follow a general approach that consists of estimating some version of the following equation: $D_{it} = \alpha X_{it} + \mu_i + \eta_t + \varepsilon_{it}$ (1) where i denotes the country index (i = 1,....., 97) and t denotes the year's index, t = 1980–2008. The dependent variable $D_{it} = (Debt/GDP)_{it}$ represents the total public debt as a percentage of GDP of the country i in year t.

The vector X_{it} represents the structural economic vulnerability variables (that is, the EVI or its components—and/or the square values of EVI or the squared values of its components). We also include in the model a set of other time-varying control variables which act as (economic) resilience-related variables. They include the fiscal balance (in percent of GDP), the GDP growth rate, the terms of trade, the real effective exchange rate, the grants (as a percentage of GDP), the inflation rate (captured here through the GDP deflator), and the quality of governance. The definition and the source of these variables are provided in Table 1 (see below). Note that we present the model estimated with and without the institutional variable (quality of governance).

μ_i represents country fixed effects that are incorporated in the model and capture the heterogeneity among countries as well as the likely importance of unobservables correlated with the error term in determining the total public debt. The use of fixed effects μ_i in our regressions is dictated by two main reasons: first, since our sample is composed of heterogeneous countries, there are likely state-invariant and unmeasured factors (colonial

histories, political and financial institutions and the degree of creditworthiness) correlated with the error term in determining the evolution of the public debt to GDP ratio. Second, our macro panel contains, in principle, most countries of interest (representing the whole population of developing countries, especially those that are structural vulnerable), and thus will not likely be a random sample from a much larger universe of countries where the use of random effects may be more suitable.

η_t are time-specific dummies that are included in all specifications to account for the general trends in the debt-to-GDP ratio, the swings in international economic policies and other common shocks to all countries, such as debt relief, that affect their public debt-to-GDP ratio over time.

The disturbance $\varepsilon_{i,t}$ is assumed to be i.i.d. (0, σ_{ε}^2)—that is, assumed not to be correlated with the explanatory variables of the model and the normality of which is not required (Baltagi, 2002).

In the next section we discuss the expected sign of the different regressors included in the model.

Table 1: Definition, Source of variables and Descriptive Statistics

Variable and Definition	Source and Comments	Observations	Mean	Standard Deviation
Pubdebtgdp = Public Debt in % of GDP	IMF's database on Public Debt – The IMF's database weblink on Gross Public debt is: http://www.imf.org/external/ns/cs.aspx?id=262.	2502	73.911	69.601
EVI = Economic Vulnerability Index	Guillaumont and Cariolle, J. (2011).	2689	40.211	11.780
Exposure = Exposure Index	Guillaumont and Cariolle, J. (2011).	2813	44.994	16.258
Shock = Shock Index	Guillaumont and Cariolle, J. (2011).	2689	35.854	15.190
Exposuresq	This is square values of the variable "Exposure". The data are computed by the Author based on data from Guillaumont and Cariolle, J. (2011).	3132	2361.679	1486.927
Shocksq	This is square values of the variable "Shock". The data are computed by the Author based on data from Guillaumont and Cariolle, J. (2011).	2982	1499.736	1271.295
Exposureshock	This variable is the interaction between the variables "Exposure" and "Shock". The data are computed by the Author based on data from Guillaumont and Cariolle, J. (2011).	2982	1653.404	954.914
Fiscal balance = Fiscal Balance in percentage of GDP	Centre d'Etudes et de Recherches sur le Developpement International (CERDI)'s Public Finance Database. Fiscal balance is the overall revenue (tax and non-tax revenue), excluding grants minus government expenditures.	2238	5.996	7.953
Gdpgrowth = Real Gross Domestic Product (GDP) growth (annual %)	World Development Indicators (WDI) 2011	2685	3.716	5.869
Termstrade = Net barter terms of trade index (2000 = 100)	World Development Indicators (WDI) 2011	2317	110.754	38.072

REER = Real Effective Exchange Rate, Base 100 = 2000	CERDI's Database: This is the Real Effective Exchange Rate, base 2005 = 100 computed by CERDI: it is the ratio of prices in the country to prices in the main import partners adjusted for variations in nominal effective exchange rate. An increase means an appreciation.	2602	183.492	3023.179
Grantsgdp = Grants in percent of GDP.	Grants data are grants disbursements by all donors expressed in current millions of US Dollars. They are extracted from the OECD Statistical Database. The GDP used to calculate the ratio of Grants in percentage of GDP is extracted from the World Development Indicators (WDI) 2011.	2700	6.265	9.460
Inflation = Inflation, GDP deflator (annual %)	World Development Indicators (WDI) 2011	2684	61.084	692.329
Importsgdp = Total Imports, in percentage of GDP	World Development Indicators (WDI) 2011	825	43.099	24.007
Qog = Quality of Governance	The quality of governance is measured by subjective indices from the International Country Risk Guide (ICRG). The quality-of-governance index from ICRG used here is an 18-point scale, created by summing the following three six-point scales: corruption in government, bureaucratic quality, and the rule of law. See the ICRG for the criteria used in coding these measures. The rationale for corruption and bureaucratic quality is obvious. The rule-of-law definition indicates that this measure reflects the government's administrative capacity in enforcing the law, as well as the potential for rent-seeking associated with weak legal systems and insecure property rights. Source: International Country Risk Guide (ICRG) Data.	1821	0.441	0.151

4.2 Discussion on the expected signs of the explanatory variables

Before proceeding to the discussion of the expected effects (signs) of our explanatory variables, we would like to mention that, in order to make our regressors predetermined with respect to the dependent variable (the total public debt), we take the precaution to use where it appears necessary the lagged values of the explanatory variables. This allows us to avoid simultaneous relationships between certain regressors and the dependent variable.

Now what about the expected effect of each explanatory variable?

The EVI's variable

In analyzing the effect of economic vulnerability on economic growth, Cordina (2004a, b) shows that increased risk can adversely affect economic growth as the negative effects of downside shocks would be commensurately larger than those of positive shocks. Furthermore, he presents a conceptual application of the 'Singapore Paradox' approach and shows evidence that, in response to a situation of vulnerability, saving and capital formation in an economy can be important sources of resilience. Guillaumont (2009) discusses the effects of each component of the (retrospective) EVI on economic growth and poverty. He concludes that the EVI reduces economic growth and, through the latter, exerts deleterious effects on the pace of poverty reduction. These impacts occur through the channels of export earnings instability, the primary instabilities (especially through their effects on public finances or through the passed through price fluctuations to producers), political instability, the smallness of the country, the structure of the economy and the location of the country.

More recently, Ferrarini (2009) re-assessed the analysis underlying the New Debt Sustainability Framework (NDSF) endorsed by the Bretton Woods Institutions (the IMF – International Monetary Fund - and the World Bank), which guides the borrowing decisions of low-income countries. This re-evaluation consists of testing the significance and the reliability of the World Bank's CPIA – Country Policy and Institutional Assessment - or the governance indicators as predictors of debt distress episodes across LICs. He obtains strong evidence that factors of illiquidity and structural vulnerability[40] are more suitable predictors of the occurrence of debt distress episodes across low-income countries (LICs). Thus by challenging the NDSF prospects, whose aim is to solve the long-standing debt crisis involving many of

[40] The EVI used is that of United Nations Department of Economic and Social Affairs—Division of Sustainable Development.

the LICs, the author concludes that the NSDF is bound to distort aid allocation away from the country-specific circumstances which truly matter for the achievement of debt sustainability.
Based on this short literature review related to the macroeconomic impact of EVI, we discuss its possible impact on public debt.

- *Hypothesis of Linear relationship between EVI and total public debt*

We first suppose the following regarding the EVI's linear effect on public debt: the structural vulnerability, by reducing tax revenue (unless the government increases taxes after either an exogenous shock or a rise in its exposure to shocks, though such a measure is politically sensitive and difficult to implement) and increasing government spending, is expected to increase the budget deficit. We also hypothesise that, irrespective of its effect on the public finances (the budget deficit), the structural vulnerability of a developing country is expected to increase its public indebtedness, either directly or indirectly, through its effect on the other control variables.
In the meantime, we can conjecture that the structural vulnerability of a country can exert a statistically nil or a reducing effect on the public indebtedness. Let us describe how such a situation can occur. When facing a rise in its vulnerability, stemming either from exposure increases or shocks rises, or both, a developing country has several options, apart from resorting to indebtedness, to accommodate the additional costs induced by this rise in structural vulnerability:

- *Option 1*: It can adjust its fiscal policies by either increasing taxes or reducing public spending or adopting both measures (a tax rise and expenditure reduction), although, as mentioned above, these measures could be politically difficult to implement.
- *Option 2*: Instead of borrowing even at low cost to cope with the additional financial needs induced by such structural vulnerability, the government can rely on non-costly financial means such as the proceeds of privatisation, seigniorage and the sale of its assets (buildings, infrastructure, mineral deposits, and various forms of liquid reserves) (Vera, 2009). However, we are unable to provide statistical evidence on the hypothesis underlying that option because of a lack of data. In the case where the government resorts to one or several of these measures, it is possible to obtain a significant negative effect of EVI on the accumulation of public debt that cancels out the effect of the fiscal balance (the coefficient of the variable capturing the 'the fiscal balance' may not be statistically significant).

- *Option 3*: The third option is for these countries to seek debt relief granted by the creditors (the extra revenues are used to cope with the shocks).

That said, to analyze empirically the channels through which the structural economic vulnerability affects public indebtedness, we proceed as follows:

- Firstly, we regress each of the control variables (considered here as the dependent variable) on the EVI (considered here as the explanatory variable) to see if the latter has an effect on the former;
- Secondly, we regress the public indebtedness variable (public debt-to-GDP ratio) on the EVI and on all the controls. Three scenarios can emerge from that regression:
    - If the EVI turned from significant to insignificant while the other controls were significant, the EVI would have an indirect effect on public indebtedness through the significant controls, provided that the EVI had a significant effect on the controls in the first set of regressions.
    - If the EVI and the controls were found to be significant, all of them would have an independent effect on public indebtedness. Other parts of it would not. The more the inclusion of the control variables weakens the effect of EVI on public indebtedness, the more important will be the indirect effect (via the controls). If the EVI coefficient changes little, it indicates that the controls are not important channels.
    - If the EVI remains significant and the controls are not significant, it indicates that the causal effect of the EVI on public indebtedness is not mediated mainly through them.

- *Hypothesis of Non-Linear relationship between EVI and total public debt*

We push our analysis further by conjecturing the existence of a non-linear relationship between the EVI and the overall public debt. The argument underlying this hypothesis is the following: based on the previous discussion of the possible channels through which the EVI can affect the overall public debt in developing countries, we can have two main expectations regarding the non-linearity of the EVI with respect to the public indebtedness:

Expectation 1: we expect the public debt not to be affected or even to be reduced in the first stages of EVI increases (in the cases of fiscal adjustment or drawing on non-costly means of financing, or debt relief), but as the EVI becomes higher, these countries will have no choice but to resort to domestic and/or external debt, thereby increasing their public

indebtedness. As a result, we expect a positive sign of the variable 'EVI square' (or the square of its components) and a negative sign of the coefficients associated with 'EVI' or its components. These coefficients may also be statistically insignificant.

Expectation 2: we also expect the public debt to rise in the first stages of the EVI increases (if the countries choose to borrow internally or abroad to accommodate the EVI increases) and then to decline for higher EVI because, for instance, of the debt relief granted by creditors to the country, or its use of non-costly financial resources or also its adoption of fiscal adjustment measures. Hence, the sign of 'EVI' or its components will be positive and that of its square or its components' square will be negative. We may also obtain here a statistically insignificant coefficient of these variables.

The fiscal balance: as mentioned above, we expect an improvement in the fiscal balance to reduce the overall public debt. If the EVI (or its components) effect translates through the fiscal balance, the impact of the latter on public debt will be statistically nil. However, we acknowledge that a statistically nil effect of fiscal balance may not necessarily be due to the presence of the EVI or its components in the model, but may also be explained by the effect of other control variables of the model that influence the fiscal balance (e.g. economic growth; the terms of trade; the quality of governance).

The real GDP growth: we expect the indebtedness of a country to rise following losses in output; that is, lowering of real GDP growth (see also Barro, 1979). Accordingly, the real GDP growth is expected to be negatively related to the accumulation of public debt.

The real effective exchange rate

The real effective exchange rate (REER) indicates a country's competitiveness. In our case, a rise in the REER means an appreciation and a decline means depreciation. The effect of the real effective exchange rate on the overall public debt of a country depends on its effect on the domestic and external debt.

Regarding the domestic debt, on the supply side its issuance may be easier to countries when the currency is appreciating because the expected appreciation allows prudent policymakers to hide the implicit insurance premium embedded in domestic currency borrowing (Caballero and Cowan, 2006; Panizza et al., 2011). On the demand side, a real appreciated exchange rate is, at any given interest rate, likely to discourage the demand of domestic currency bonds as

investors may foresee an ex-post appreciation of the foreign currency rate (a real depreciation of local currency; see also Panizza et al., 2011). Furthermore, in terms of valuation effects, a real effective exchange rate appreciation (depreciation) automatically induces a higher (lower) domestic indebtedness of the government.

With respect to the external public debt, the effect of REER changes on its build-up is also ambiguous. In fact, a real exchange rate depreciation will lead to a declining of the external debt stock if the induced rise in export earnings of this depreciation is sufficiently enough to service the external debt; otherwise, the depreciation of the REER will result in a rise of external indebtedness (Craigwell et al., 2010; see also Ng'eno, 2000).

Overall, we cannot conclude a priori about the effect of REER changes on the accumulation of the total public debt (domestic and external debt).

The terms of trade

An improvement in terms of trade (an increase in the relative price of exportables for a country) is likely to increase the export (foreign) revenues of the beneficiary country, reduce current expenditures and therefore improve the fiscal balance. Note that the reduction effect of public expenditures owe to the terms of trade improvement appears through a relative decline in the price of inputs (in the cases where imports represent an important share of expenditures - which is usually observed in many developing countries. Furthermore, such improvement in terms of trade, by increasing the economic growth may also reduce the need for social assistance from government and in fine, add to the reduction of current expenditures. Thus, an improvement in terms of trade is expected to be positively related to lower external and /or domestic borrowing.

Conversely, a decline in terms of trade, by lowering revenue, increasing (substantially) public spending and thus worsening the fiscal balance, will likely result in higher total public debt. As a result, the likelihood of excessive debt will rise. The positive effect of such terms of trade deterioration on public expenditures translated through for example, the rise of social assistance needs, and the high demand by public enterprises of support from the government because they cannot adjust their pricing policies to changes in export and import prices.

The grants

According to Cline (2003), since in low-income countries (LICs) the grants elements (foreign grants, which represent a substantial fraction of GDP) are available to pay some part (or all) of the interest due on debt, it is important to modify our previous debt sustainability condition by taking into account the amount of foreign grants as a fraction of GDP. This is why we include in our model specification the foreign grants as a percentage of GDP. We thus expect the grants to alleviate the burden of indebtedness of developing countries—that is, to exert a negative effect on public debt. But we can also hypothesise that the higher the grants are for a developing country, the lesser it will be inclined to correctly manage its public finances to avoid unsustainable debt situations. In such instances, the grants will exert a positive effect on the total public debt.

The inflation rate

The impact of inflation on the public debt depends on how the latter is distributed among domestic and foreign creditors. In the case of developing countries where (usually) a substantial part of the public debt is denominated in foreign currency, the inflation impacts directly the domestic debt-to-GDP ratio and indirectly the ratio of external debt to GDP through the real effective exchange rate.

A rise in inflation erodes the real value of the domestic debt hold by creditors and the effective debt ratio, unless all domestic debt is indexed to prices or foreign currencies (though according to Panizza et al., 2011, in such cases inflation can debase indexed to prices if the government tinkers with the price index), a government can inflate away the domestic public debt by money creation, with the result of this inflating away of debt depending on the share of debt that is indexed to inflation. Panizza et al. (2011)[41] also point out the exceptional case where inflation can lead to a rise of public debt: in the case of a country facing a real appreciation (that is, where inflation outweighs the currency depreciation) and where a large share of domestic debt is indexed to inflation, the valuation effects will create a positive link between inflation and domestic currency debt.

[41] These authors recognise, however, that such a situation is exceptional and argue it will likely be dominated by the case where inflation impacts negatively the domestic debt, in the absence of financial repression.

The Imports

A developing country usually has a higher need for imports (in terms of inputs, equipment …etc) for its development. An increase in imports will deteriorate the trade balance and substantially reduce the ratio of reserves to imports (although the level of reserves depends on many factors of which the exchange rate regime). Hence, for a given level of international reserves, the likely result will be a declining of the national revenue and thereby an accumulation of public debt.

Suppose now that this country incurs a substantial level of public debt. Unless it has accumulated sufficient foreign reserves to simultaneously repay its debt and finance its imports, it will likely be constrained to reduce its imports (for a given level of international reserves) because of its incapacity to secure additional loans on the domestic market (if the latter is sufficiently developed) and/or on the international markets (for many countries, via the bilateral donors or multilateral financial institutions),. Hence, as this variable may be endogenous with respect to the total public debt, due to the reverse causality among other factors, we consider its (the imports-to-GDP ratio) one-year lagged values in our model specification.

The quality of governance

We introduce this variable in the model because we think that it is not only a main determinant of public debt management, but it is also susceptible to influence the effect of EVI (Economic Vulnerability Index) on the public debt. In fact, we expect the better quality institutions (especially fiscal ones) to be associated with a lower public debt. In addition, there is a need for developing countries (especially small countries and Low Income Countries) that are structurally vulnerable to set up the adequate institutions that should promote competitiveness, build economic resilience and promote sustainable development (Farrugia, 2007). More specifically, as almost all developing countries are open to international trade, they should need institutions that boost their competitiveness (state and private sector competitiveness). In other words, these institutions should help them create a conducive operational environment for businesses in order to enable them take advantage of the globalization process (Farrugia, 2007). Furthermore, Acemoglu et al. (2002) discuss why substantial economic instability may arise in societies with institutional problems. More particularly, they highlight among others that, in weak institutional societies, politicians may be forced to pursue unsustainable policies in order to satisfy various groups and remain in

power. These unsustainable policies will in turn generate greater economic volatility, the latter being captured through the EVI. The same authors also underscore that with weak institutions, entrepreneurs may choose sectors/activities from which they can withdraw their capital more quickly, thereby contributing to potential economic instability. The institutions in developing countries and particularly in small countries should therefore be as strong as possible to reflect the aspects of governance in their economic environment. Therefore we include in our model the variable 'quality of governance' and expect it to be negatively associated with the build-up of public debt. Note that as aforementioned, we transform this variable to avoid the simultaneity bias with respect to the total public debt. We consider the average value of the past three years (not counting the current year) for a given country and a given year, (see Larvigne, 2011).

4.3 The econometric technique

As the time and cross-sectional dimensions of our panel data are important (T = 29 and N = 74), there will likely be serial correlation, heteroscedasticity and contemporaneous correlation in residuals of the model. Therefore we perform three statistics tests where the null hypotheses are respectively: the absence of autocorrelation test (Wooldridge AR[1] test); the homoscedasticity test and the absence of cross-sectional dependence[42] test (unfortunately, because of the unbalanced and short nature of our samples, we are not able to implement any of the available tests for cross-sectional dependence; Hoyos and Sarafides, 2006). The results allow us to conclude for the presence of serial correlation and heteroscedasticity in the residuals. To address these concerns, we use the fixed effects technique with the Driscoll and Kraay's[43] (1998) standard errors. In fact, in addition to their heteroscedasticity consistence, Driscoll-Kraay's standard errors estimates are both robust to within- and between-group[44] dependence (robust to very general forms of spatial and temporal dependence in the residuals when the time dimension of the panel is large[45]). The spatial correlation may in practice result

[42] The erroneous ignorance of spatial correlation in panel data estimation severely biased the estimates.
[43] We perform our regressions using the stata's command 'xtscc' implemented by (Hoechle, 2007) to obtain Driscoll and Kraay's covariance matrix.
[44] The robustness of Driscoll-Kraay's standard errors are certainly based on asymptotic theory, but their values have been demonstrated in panels down to T = 5 (Hoechle, 2007).
[45] Driscoll and Kraay's robust standard errors underperform White's robust standard errors in the absence of between-group dependence while outperforming in its presence (Hoechle, 2007).

from unobserved common shocks to the total public debt that is not captured either by the time dummies or by the other determinants of the public debt.

Another econometric technique that could allow us to perform our regressions using fixed effects while dealing with serial correlation, heteroscedasticity and contemporaneous correlation in the residuals is the panel corrected standard errors (PCSEs) developed by Beck and Katz (1995). However, for the reason mentioned above (the unbalanced and shortness nature of our sample and sub-samples), we cannot use this technique. Finally, we rely solely on the fixed effects technique where standard errors are computed using the Driscoll-Kraay (1998) technique.

5. The empirical results

In this section, we discuss the results obtained from the regressions by either employing fixed effects with cluster-robust standard errors (Table 2 and Table 5) or fixed effects where the standard errors are corrected with Driscoll-Kraay's (1998) technique (Table 3 and Table 4).

5.1 An empirical analysis of the channels through which the EVI affects the total public debt

In this sub-section, we do not interpret the model estimations' results per se, but rather we discuss whether there is a direct significant impact of the variable "EVI" on the different control variables. To explore the existence of this direct significant impact, we perform a set of tests. Hence, we proceed as follows: we consider as a dependent variable each of the control variables introduced in the model (both the ones with one-year lagged values introduced because of the likely simultaneity bias and the ones that are not lagged) that we regress on the "EVI" variable. As we could not regress the lagged explanatory variables on EVI_t, but rather on $EVI_{t,1,}$ we need to ensure that $EVI_t \cong EVI_{t-1.}$ To do so, we perform a stationarity test on the variable EVI_t. If the EVI is judged to contain unit root (that is, it is not stationary), then we can write that $EVI_t \cong EVI_{t-1}$. The results of the stationarity test suggest that the EVI is not stationary, that is, it contains unit root (the p-value associated with the Fisher test for panel unit root where the null hypothesis is that the "variable "EVI" contains unit root" is 0.99). As a consequence, we can write $EVI_t \cong EVI_{t-1.}$

Given this previous result, we now perform our analysis of the existence of a direct impact of EVI on the other control variables, depending on whether the latter are lagged or not. The results are displayed in Table 2 below**.** Consider first the results obtained for the entire sample

of developing countries. We can observe from this table that the EVI affects significantly only the "grants-to-GDP ratio" and the "quality of governance" variables (though at 10% level of significance). The effects of the EVI on the other variables are statistically insignificant. We therefore conclude that the EVI exerts a direct effect only on these two variables. From columns (1) to (3) of Table 3 (see below), we observe that the significance of the EVI's effect on the public debt-to-GDP ratio remains robust to the inclusion of the controls, though the coefficient of the EVI declines slightly between column [1] (that is, the model with only the EVI variable as regressor) and column [2] (the model with the EVI and all the controls). The significance of the EVI's components in column [3] confirms the previous results obtained for the EVI variable. The combination of these results with those of the developing countries in Table 2 leads us to conclude that there is at least a part of the EVI that exerts an independent effect on the build-up of public debt in developing countries, irrespective of the controls effects. Given the slight weakening of the EVI's coefficient (from column [1] to column [2]), we can conclude that the EVI's effect passes through certain control variables, namely the grants-to-GDP ratio and the quality of governance. We also observe evidence from column [3] of Table 3 that the significance of the EVI's effect on the total public debt of developing countries is driven by both "exposure" and "shocks" factors in these countries.

Table 2: *The effects of Economic Vulnerability on each control variable over the full sample of developing countries as well as the sub-samples.*

		Dependent Variables							
	Explanatory Variables	**Fiscal_balance$_{t-1}$**	**Gdpgrowth$_{t-1}$**	**Termstrade**	**Reer$_{t-1}$**	**Grantsgdp$_{t-1}$**	**Inflation$_{t-1}$**	**Importsgdp$_{t-1}$**	**Qog**
Developing Countries	Evi [**or Evi$_{t-1}$**]	-0.0566	0.0871	0.570	22.81	0.194**	6.952	-0.157	-0.00256*
		(0.0468)	(0.0636)	(0.345)	(22.73)	(0.0884)	(4.332)	(0.107)	(0.00149)
	Constant	8.228***	0.198	88.34***	-734.2	-1.659	-214.7	45.84***	0.535***
		(1.843)	(2.553)	(13.33)	(915.4)	(3.566)	(173.9)	(4.290)	(0.0555)
	Observations - Countries	2,122-97	2,515-97	2,272-97	2,509-97	2,527-97	2,514-97	2,510-97	1,747-74
	Within R-squared	0.003	0.006	0.007	0.001	0.025	0.003	0.006	0.018
	Significance of Country Fixed Effects	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
LICs (Low-Income Countries)	Evi [**or Evi$_{t-1}$**]	-0.0437	0.144	0.448	0.453	0.384**	0.270	-0.0961	-0.00373*
		(0.0629)	(0.136)	(0.613)	(1.006)	(0.165)	(4.547)	(0.201)	(0.00212)
	Constant	3.963	-2.888	97.73***	110.7**	-4.550	52.60	38.69***	0.531***
		(2.683)	(5.857)	(26.19)	(43.52)	(7.139)	(196.3)	(8.650)	(0.0880)
	Observations - Countries	790-34	852-34	814-34	868-34	862-34	851-34	841-34	560-24
	Within R-squared	0.002	0.012	0.005	0.0004	0.049	0.000	0.002	0.052
	Significance of Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LMICs (Lower-Middle Income Countries)	Evi [**or Evi$_{t-1}$**]	-0.105	0.0135	0.732	82.19	0.0895	16.06	-0.250	-0.00364
		(0.0975)	(0.0600)	(0.436)	(75.25)	(0.0733)	(11.59)	(0.178)	(0.00255)
	Constant	10.68***	3.496	79.16***	-2,814	0.927	-534.1	52.08***	0.566***
		(3.659)	(2.268)	(15.75)	(2,856)	(2.784)	(437.9)	(6.767)	(0.0900)
	Observations - Countries	758-34	893-34	805-34	872-34	909-34	893-34	906-34	669-28
	Within R-squared	0.009	0.0002	0.016	0.005	0.012	0.012	0.014	0.026
	Significance of Country Fixed Effects	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
UMICs (Upper Middle Income Countries)	Evi [**or Evi$_{t-1}$**]	0.00167	0.0844*	0.585	-1.145	0.0177	6.625	-0.135	0.000742
		(0.0911)	(0.0465)	(0.618)	(0.782)	(0.0190)	(4.470)	(0.160)	(0.00259)
	Constant	10.35***	0.386	86.64***	153.2***	0.925	-206.8	46.80***	0.484***
		(3.402)	(1.838)	(22.69)	(30.92)	(0.755)	(176.6)	(6.293)	(0.0909)
	Observations - Countries	574-29	770-29	653-29	769-29	756-29	770-29	763-29	518-22
	Within R-squared	0.000	0.006	0.005	0.011	0.002	0.009	0.004	0.002
	Significance of Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. We use as estimator, the fixed effects where the "robust" and "cluster" options are used to correct respectively for heteroscedasticity of residuals due respectively to correlation of residual within countries and between countries (clusters).

***Table3**: The effects of Economic Vulnerability on Public Debt – the full sample of Developing Countries - Fixed Effects Driscoll-Kraay estimator (FEDK).*

	Dependent Variable: Total Public Debt in percentage of GDP											
Explanatory Variables	***Developing Countries***			***LICs***			***LMICs***			***UMICs***		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Evi	1.406***	0.840***		1.734***	0.530		1.987	1.670		-0.704	0.970**	
	(0.354)	(0.172)		(0.530)	(0.334)		(1.268)	(1.440)		(0.469)	(0.414)	
Exposure			1.689***			1.786**			-1.428			1.398*
			(0.566)			(0.649)			(1.561)			(0.792)
Shock			0.349***			0.159			0.959			0.423*
			(0.0930)			(0.148)			(0.708)			(0.207)
$Fiscal\_balance_{t-1}$		-0.260	-0.314		-0.188	-0.232		-1.476***	-1.410***		0.433	0.398
		(0.248)	(0.241)		(0.569)	(0.580)		(0.361)	(0.372)		(0.366)	(0.355)
$Gdpgrowth_{t-1}$		-1.083***	-1.011***		-1.230***	-1.121***		-1.651***	-1.815***		-0.801	-0.805
		(0.142)	(0.147)		(0.227)	(0.226)		(0.555)	(0.593)		(0.475)	(0.473)
Termstrade		-0.176**	-0.190***		-0.116*	-0.141**		-0.184	-0.170		-0.194	-0.195
		(0.0637)	(0.0635)		(0.0609)	(0.0581)		(0.167)	(0.164)		(0.129)	(0.131)
$Reer_{t-1}$		0.0195	0.0195		-0.140***	-0.140***		0.0149	0.0128		0.147*	0.138*
		(0.0266)	(0.0271)		(0.0414)	(0.0422)		(0.0198)	(0.0193)		(0.0755)	(0.0721)
$Grantsgdp_{t-1}$		-0.251	-0.218		-0.533*	-0.489*		0.976	1.061		5.323***	4.660***
		(0.477)	(0.471)		(0.278)	(0.274)		(1.344)	(1.274)		(1.279)	(1.402)
$Inflation_{t-1}$		0.00181	0.00165		1.47e-05	-0.000232		0.00632**	0.00665**		-0.00326*	-0.00292*
		(0.00127)	(0.00129)		(0.000885)	(0.000835)		(0.00268)	(0.00258)		(0.00169)	(0.00159)
$Importgdp_{t-1}$		0.489***	0.513***		0.801***	0.808***		0.674***	0.616***		-0.297	-0.278
		(0.117)	(0.113)		(0.276)	(0.279)		(0.209)	(0.168)		(0.239)	(0.228)
Qog		-18.65**	-17.99*		-9.545	-6.376		-19.01	-18.26		-41.89**	-44.43**
		(8.788)	(9.478)		(21.40)	(21.89)		(28.97)	(29.23)		(19.65)	(19.59)
Constant	-		21.01	-36.51*	-	-	-13.62	-	-	66.80***	-	-
	-		(23.26)	(20.85)	-	-	(49.65)	-	-	(19.57)	-	-
Observations – Countries	2,436-96	1,334-74	1,334-74	801-33	455-24	455-24	886-34	497-28	497-28	749-30	382-22	382-22
Within R-squared	0.0945	0.2231	0.2277	0.3467	0.4276	0.4353	0.0968	0.3607	0.3680	0.1233	0.2586	0.2625
Significance of Country Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Significance of Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Standard Errors (corrected with Driscoll-Kraay technique) are in parenthesis. The sign "–" in the table means that the constant is omitted by the regression.

Consider now the sub-sample of Low-Income Countries (LICs). The results reported in Table 2 suggest evidence that the EVI affects significantly the same variables as in the case of developing countries: the "grants-to-GDP ratio" and the "quality of governance". In the meantime, the results in columns [4] and [5] of Table 3 suggest that the coefficient of the EVI turns from significant (column [4]) to insignificant (column [5]). Therefore, we can conclude that the EVI exerts a significant indirect effect on the accumulation of the public debt through the variables "grants-to-GDP ratio" and "quality of governance". An interpretation of these results could be the following: all other things being equal, EVI reduces the quality of governance because repeated experiences of structural shocks by LICs (and/or increasing these countries' exposure to shocks) will reduce their capacity to develop appropriate policy and institutional responses to further shocks. As a result, these countries will likely accumulate their public indebtedness to cope with such shocks. In addition, LICs facing higher structural vulnerability could obtain from the international community a high level of grants-to-GDP ratio which in turn could likely reduce its inclination to maintain fiscal discipline. As a result, the government will increase its public indebtedness.

The results in column [6] of Table 3 suggest that the exposure of LICs to shocks influences significantly their build-up of public debt, irrespective of the effect of the other control variables, whereas the shocks affecting these countries do not.

Let us now turn to Lower-Middle Income Countries (LMICs). In Table 2, we observe evidence that the EVI affects significantly none of the controls, whereas in columns [7] and [8] of Table 3, the EVI's coefficient remains always insignificant. We conclude that the EVI exerts no significant effect on the accumulation of public debt in these countries. This conclusion remains valid for the EVI's components (see column [9] of Table 3).

For the last sub-sample, that is, the Upper Middle Income Countries (UMICs), evidence is shown in Table 2 that the EVI exerts a significant effect only on the real GDP growth, though at 10% level of significance. At the same time, we obtain evidence from columns [10] and [11] of Table 3 that the EVI's coefficient turns from non-significant to significant. The combination of these different results allows us to draw the conclusion that the EVI exerts an independent effect on the public indebtedness of these countries, irrespective of the controls effects. In column [12] of Table 3, the results suggest that this significant effect of the EVI is driven by both "exposure to shocks" and "shocks" themselves in UMICs.

5.2 Interpretation of the results

In this sub-section, we interpret the results reported in Tables 3 to 5. These results are related to the full sample of developing countries as well as the sub-samples of LICs, LMICs and UMICs. In the previous section, we have only discussed whether the EVI exerts a direct or indirect effect on the total public debt of developing countries (and the three sub-samples), as well as the channels through which such an effect is materialized. Table 3 (see columns [2] and [3], [5] and [6], [8] and [9] and, [11] and [12]) reports the results associated with the EVI/or its components and the control variables of the model. We interpret in detail the results associated with the EVI/or its components and the control variables of the model. Table 4 presents the results associated with the EVI/and its components, the EVI's square values/and the square values of its components, as well as the control variables. Table 5 reports the results stemming from splitting the time period 1980-2008 into 10-year intervals (1980-1989; 1990-1999; and 2000-2008) with a view to verifying how the parameters evolve over the decades. It is worth noting that the results from the regressions on the panel time series over the whole period could be different from the ones carried out on the panel over decades. In fact these results are often different and there is no reason for them to be the same because the methods used to control for common shocks are different. As mentioned in the section 4.1, time-specific dummies are included in the model of panel time series over the whole period to account for the common shocks that affect all countries, whereas in the model over decades, the average of data over decades is expected to smooth or even eliminate the effect of these common shocks.

***Table 4**: The effects of Structural Economic Vulnerability on Public Debt over the full period 1980-2008 – Fixed Effects Driscoll-Kraay estimator (FEDK).*

	Dependent Variable: Total Public Debt in percentage of GDP							
Explanatory Variables	***Developing Countries***		***LICs***		***LMICs***		***UMICs***	
	FE-DK	**FE-DK**	**FE-DK**	**FE-DK**	**FE-DK**	**FE-DK**	**FE-DK**	**FE-DK**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Evi	-5.197**		-1.160		-10.87**		-5.812***	
	(2.245)		(1.794)		(4.045)		(1.249)	
Evisq	0.0710**		0.0194		0.144***		0.0832***	
	(0.0259)		(0.0187)		(0.0465)		(0.0184)	
Exposure		-2.716		-3.683		-10.09*		-2.749*
		(1.638)		(4.493)		(4.959)		(1.591)
Exposuresq		0.0452**		0.0707		0.0920**		0.0214
		(0.0192)		(0.0503)		(0.0329)		(0.0185)
Shock		-2.446**		-0.122		-4.787**		-2.962***
		(1.010)		(0.651)		(2.056)		(0.960)
Shocksq		0.0231**		0.0200***		0.0283		-0.000110
		(0.00940)		(0.00547)		(0.0241)		(0.00916)
Exposureshock		0.0199		-0.0285**		0.0726		0.0865***
		(0.0161)		(0.0103)		(0.0463)		(0.0253)
$Fiscal\_balance_{t-1}$	-0.102	-0.166	-0.190	-0.254	-1.100***	-0.846**	0.685*	0.606*
	(0.208)	(0.229)	(0.561)	(0.523)	(0.367)	(0.374)	(0.359)	(0.326)
$Gdpgrowth_{t-1}$	-1.096***	-0.993***	-1.230***	-1.072***	-1.722***	-1.778***	-0.893*	-0.871*
	(0.142)	(0.130)	(0.224)	(0.239)	(0.519)	(0.502)	(0.463)	(0.437)
Termstrade	-0.181***	-0.196***	-0.121**	-0.164***	-0.129	-0.115	-0.195	-0.167
	(0.0562)	(0.0535)	(0.0582)	(0.0584)	(0.148)	(0.132)	(0.121)	(0.135)
$Reer_{t-1}$	0.0113	0.0104	-0.139***	-0.122***	0.00408	0.00903	0.140*	0.162**
	(0.0275)	(0.0284)	(0.0417)	(0.0412)	(0.0195)	(0.0193)	(0.0705)	(0.0770)
$Grantsgdp_{t-1}$	-0.150	-0.101	-0.500*	-0.434**	1.239	1.374	3.580**	4.155*
	(0.431)	(0.408)	(0.275)	(0.202)	(1.022)	(1.242)	(1.338)	(2.125)
$Inflation_{t-1}$	0.00178	0.00160	4.91e-05	0.000226	0.00444**	0.00374**	-0.00358**	-0.00259
	(0.00118)	(0.00112)	(0.000892)	(0.000786)	(0.00176)	(0.00179)	(0.00172)	(0.00170)
$Importsgdp_{t-1}$	0.443***	0.461***	0.809***	0.815***	0.557**	0.604***	-0.426	-0.370
	(0.123)	(0.120)	(0.280)	(0.228)	(0.217)	(0.191)	(0.257)	(0.225)
Qog	-19.06*	-21.33*	-9.107	-2.335	-26.60	-26.51	-44.69**	-36.94**
	(9.233)	(10.87)	(21.19)	(23.47)	(24.12)	(24.43)	(20.14)	(17.25)
Constant	193.0***	159.4***	-	-	-	-	-	-
	(49.24)	(53.55)	-	-	-	-	-	-
Observations - Countries	1,334-74	1,334-74	455-24	455-24	497-28	497-28	382-22	382-22
Within R-squared	0.2442	0.2566	0.4292	0.4581	0.4184	0.4229	0.3013	0.3499
Significance of Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Significance of Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Standard Errors clustered by country to correct for heteroscedasticity in the residuals. The sign "–" in the table means that the constant is omitted by the regression.

***Table 5**: The effects of Structural Economic Vulnerability on Public Debt –Fixed Effects with clustered Standard errors - NB: We consider sub-periods of decades: 1980-1989; 1990-1999 and 2000-2008.*

	Dependent Variable: Total Public Debt in percentage of GDP							
Explanatory Variables	***Developing Countries***		***LICs***		***LMICs***		***UMICs***	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Evi	1.729	-12.43***	3.266*	-15.12***	-1.039	-4.548	-0.117	-5.919**
	(1.098)	(3.820)	(1.743)	(5.318)	(1.546)	(3.620)	(1.033)	(2.343)
Evisq		0.174***		0.216***		0.0496		0.0750**
		(0.0518)		(0.0703)		(0.0580)		(0.0289)
$Fiscal\_balance_{t-1}$	1.128	1.229	3.283	3.753**	0.771	0.813	0.958	0.927
	(0.919)	(0.831)	(1.992)	(1.740)	(0.547)	(0.518)	(0.817)	(0.815)
$Gdpgrowth_{t-1}$	-2.360	-2.014	0.408	-0.565	-7.257***	-7.136***	-5.197**	-4.703**
	(2.038)	(1.955)	(5.170)	(4.726)	(2.124)	(2.094)	(1.984)	(2.050)
Termstrade	-0.0924	-0.0773	0.241	0.382	-0.364**	-0.371**	-0.201	-0.182
	(0.122)	(0.123)	(0.393)	(0.338)	(0.164)	(0.164)	(0.136)	(0.134)
$Reer_{t-1}$	0.0735	0.0197	-0.100	-0.135**	0.538***	0.503***	0.383*	0.399*
	(0.134)	(0.112)	(0.0611)	(0.0626)	(0.0729)	(0.100)	(0.203)	(0.197)
$Grantsgdp_{t-1}$	4.476**	3.520**	2.874	1.655	1.148	1.266	10.07***	10.97***
	(1.765)	(1.446)	(1.822)	(1.845)	(3.065)	(2.956)	(2.862)	(2.569)
$Inflation_{t-1}$	0.0369**	0.0343**	0.0321*	0.0287**	0.0281	0.0256	-0.0287**	-0.0269*
	(0.0158)	(0.0136)	(0.0170)	(0.0135)	(0.0209)	(0.0190)	(0.0132)	(0.0133)
$Importsgdp_{t-1}$	-0.257	-0.814	-0.978	-1.207	-0.843	-0.889	-0.951*	-1.259**
	(0.504)	(0.517)	(0.786)	(1.037)	(0.594)	(0.558)	(0.519)	(0.523)
Qog	47.86	46.71	65.82	51.48	-8.143	-4.939	-100.7*	-102.7*
	(33.17)	(29.10)	(82.10)	(40.81)	(48.41)	(49.40)	(57.52)	(55.31)
Constant	-21.68	269.1***	-87.75	297.1**	147.0***	207.5***	122.5***	228.8***
	(67.62)	(62.30)	(129.0)	(113.7)	(52.10)	(55.73)	(34.56)	(47.50)
Observations - Countries	176-74	176-74	55-24	55-24	64-28	64-28	51-22	51-22
Within R-squared	0.379	0.474	0.571	0.676	0.867	0.870	0.374	0.433
Significance of Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Standard Errors (corrected with Driscoll-Kraay technique) are in parenthesis. The sign "–" in the table means that the constant is omitted by the regression.

Let us start with Table 3 where only the EVI or its components are included in the model, in addition to the control variables (see columns [2] and [3], [5] and [6], [8] and [9] and [11] and [12] of Table 3). Note that for our sample and each of our sub-samples, the results show evidence that replacing the EVI by its components ("Exposure" and "shocks") does not change neither the statistical significance nor the direction of the coefficients of control variables.

For developing countries as the full sample, we obtain that the structural economic vulnerability increases significantly the total public debt-to-GDP ratio. This positive effect is particularly explained by higher exposure to shocks and higher shocks in these countries. In addition, the real GDP growth, the terms of trade, and the imports-to-GDP ratio exhibit the expected effect on the total public debt; the other controls exert no effect on the public indebtedness of these countries.

For LICs, whereas evidence is shown that the composite index of structural economic vulnerability (EVI) does not affect significantly the public indebtedness of these countries, we also find -when turning to the EVI's components-, that the greater the exposure of these countries, the greater their build-up of total public debt. Regarding the controls, a rise in real GDP growth, an improvement in terms of trade, a depreciation of the real effective exchange rate, as well as an increase in the grants-to-GDP ratio appear to affect significantly and negatively the total public debt. As expected, a rise in the imports-to-GDP ratio induces public debt accumulation. The other control variables are insignificantly related to the build-up of public debt in these countries. However, these results obtained for LICs appear to contrast with the Bretton Woods institutions' approach of debt sustainability in LICs where institutions are key determinants of LICs' public debt sustainability[46].

The accumulation of public debt in LMICs is driven neither by the EVI nor by any one of its components, but rather only by a deterioration of the fiscal balance, a decline in real GDP growth rate, high inflation and an increase in imports (in percent of GDP).

Finally, in UMICs, the structural economic vulnerability increases significantly the accumulation of public debt, a result which is confirmed when turning to the EVI's components. With regard to controls, the decline of public debt is only the fact of a depreciation of the real effective exchange rate, a decline of the grants-to-GDP ratio, a rise of inflation and a good quality of governance.

[46] The coefficient of the variable « quality of governance » is not statistically significant.

Let us examine the results reported in Table 4. At the outset, we would like to mention that for the full sample as well as for the sub-samples, the significance of the controls almost always remains the same, irrespective of whether we consider the model with the EVI variable or the one with its components. In addition, in Table 5, the coefficients of the controls in each pair of columns almost always exhibit the same significance.

Consider first our full sample of developing countries.

The results in column [1] of Table 4 suggest, all other things being equal, evidence of a non-linear relationship (in the form of a 'U' curve) between the EVI and the total public debt: on average, as the EVI increases, the total public debt decreases, but beyond the threshold EVI value of approximately 37 an additional rise in the EVI is associated with an accumulation of public debt. In fact, as we have already discussed in section 4.2, this result can find its interpretation in expectation 1, that is, until an average threshold of 37 for the EVI is reached, these countries resort to either fiscal adjustments, temporary debt relief obtained from multilateral institutions or bilateral creditors, or the use of their non-costly financial means (either privatisation proceeds, or seigniorage, or the sale of public assets or public investments proceeds) to cope with such structural vulnerability. However, beyond this threshold, countries do not have any other options than borrowing either abroad (inducing an increase in external debt) or domestically (thus raising the domestic debt), which leads to a higher total public debt. Turning to column [2] of Table 4, we obtain a non-linear relationship between the EVI's components and their square values, and the total public debt. Indeed, a rise in exposure of these countries to external shocks appears to increase permanently their indebtedness, whereas the shocks variable exhibits a U-shaped relationship with respect to public debt (the turning point is 52.9).

Regarding the other control variables, we observe from columns [1] and [2] of Table 4 that strong economic growth, an improvement in terms of trade and a decline in the imports-to-GDP ratio are associated with a fall in the total public debt-to-GDP ratio; the other control variables do not affect significantly the accumulation of public debt.

Turning to Table 5, evidence is shown (which confirms our previous results) that over the decades, there is a non-linear relationship, in the form of a "U" curve, between the EVI and the public indebtedness of developing countries.

Consider now the three sub-samples.

For LICs, the results are more interesting when we introduce either both the EVI and its square values or its components and their square values into the model: neither the squared EVI variable nor the EVI variable itself exerts a significant effect on the total public debt, suggesting the absence of a non-linear relationship between the composite index EVI and the public debt for LICs (column [3] of Table 5). When turning to column [4] of Table 5, we obtain that the non-significance effect of the EVI on the total public debt hides other results if we consider the EVI's components: the coefficients of the variable "shock square" and the variable "exposureshock" -which captures the interaction between the variables "shock" and "exposure" - are respectively significantly positive and negative. This is suggestive of the fact that the size of shocks and that of the exposure to shocks are non-linearly related to the accumulation of public debt by these countries. This is because in column [4] of Table 5, the results show that the final effect of both "exposure to shocks" and "shocks" on the build-up of public debt depends on the sizes of both of these two variables. Note that the variables "shock", "exposure" and "exposure square" are non-significantly related to the total public debt of LICs.

The results in column [3] of Table 5 lead us to conclude that the EVI is positively and significantly (though at only 10% level of significance) associated with the public debt accumulation in LICs over decades. In contrast with the absence of a non-linear relationship between the EVI and the build-up of public debt found above for LICs, we find evidence in column [4] of Table 5 that over decades the EVI is non-linearly (U-shaped relationship) associated with the accumulation of public debt in LICs, with the turning point of the EVI being approximately 35. As aforementioned, this peculiar result is not in fact surprising because of the different methods used to control for the common shocks that affect the countries of our sample and our different sub-samples.

The findings are different for the sub-samples of both LMICs and UMICs. Indeed, the results (columns [5] to [8] of Table 4) suggest a non-linear relationship in the form of a U curve between the EVI and the total public debt. The threshold of the EVI calculated for LMICs is 37.74, while that of UMICs is 34.92.

Analysis of the association between the EVI's components and the build-up of public debt in LMICs and UMICs (see columns [6] and [8]) suggests the following:

- For LMICs, there exists a U-shaped curve between the "exposure" variable and the public debt (with a turning point of 54.84) but not between public debt and the

"shock" variable, where the latter is linearly associated with the dependent variable (the greater the shocks that affect these countries, the lower the accumulation of their public debt).

- For UMICs, we also observe a non-linear relationship between the EVI's components and the total public debt: the impact on the total public debt of the size of the exposure to shocks depends on the size of the shocks and vice-versa, thus leading a priori to an uncertainty of the sign of the overall effect. The non-linear relationship previously highlighted between the EVI and the public debt for these countries is dictated not by the square values of the variables "exposure" and "shock", but by the linear terms of these two variables as well as the interaction between them: the coefficients associated with the variable "exposure" and "shock" are significant and negative, whilst the coefficient of the variable "exposureshock" is positive and statistically significant.

For each of these sub-samples, the regressors that appear to be significant are the same in columns [5] and [6] of Table 4 for LMICs and in columns [7] and [8] for UMICs. In fact, for LMICs, the reduction of public debt accumulation is associated (as expected) with an improvement of the fiscal balance, a higher level of economic growth, a rise in inflation and unexpectedly, a rise in imports. This unexpected result obtained for the variable imports-to-GDP ratio may be explained by the fact that these countries' imports, by contributing to a positive economic growth (see for e.g., Frankel and Romer, 1999; Humpage, 2000) reduces the build-up of public debt. With respect to UMICs, the build-up of public debt appears to be explained by an improvement of the fiscal balance, a fall in real GDP growth (although the two latter results are significant at only 10%), an appreciation of the real effective exchange rate, a rise in the grants-to-GDP ratio and a deterioration in the quality of governance.

The analysis of the behaviour of the EVI with respect to the total public debt for these two sub-samples over decades (columns [5] to [8] of Table 5) suggests the following:

- For LMICs, the absence of a long run average effect of the EVI on the total public debt found in column [8] of Table 3 is confirmed here (see column [5] of Table 5). Furthermore, contrary to our previous findings (see column [5] of Table 4), we do not obtain evidences of the existence over decades of a non-linear relationship between the total public debt and the EVI. In other words, the non-linear relationship between the EVI and the total public debt is only valid for the analysis carried out in time series over the whole period of study, but not over individual decades. The explanation of this result is once again rooted on the reasons provided above.

- For UMICs, there is no effect of the EVI on the build-up of public debt over decades (see column [7] of Table 5) when we introduce the EVI variable but not its square in our model. This finding (for the analysis performed over decades) contrasts with the one obtained in column [11] of Table 3. However, evidence (when we introduce both the EVI and its square in the model) of a non-linear relationship in the form of a U curve between the EVI and the total public debt is obtained over decades (see column [8] of Table 5). This validates our previous findings in column [7] of Table 4.

6. Conclusion and policy implications

In this study we explore how the structural vulnerability in developing countries influences their indebtedness. To do so, we use the (structural) economic vulnerability index (EVI) jointly computed by Guillaumont et al. (2011) and the UN-DESA and focus on a panel of 97 developing countries over the period 1980–2008. In addition to the full sample of the 97 developing countries, we also consider three sub-samples (according the World Bank's classification): LICs; LMICs and UMICs. To perform our regression, we employ the fixed effects with Driscoll-Kraay's (1998) technique to correct standard errors for spatial and temporal dependence.

After controlling for several potential covariates, we obtain the following results regarding the EVI's effects on total public debt:

- With regard to the full sample of developing countries, EVI affects positively the build-up of public debt, but this positive effect appears after a threshold of the EVI. In other words, we observe the existence of a non-linear relationship (in the form of a U curve) between the EVI and public indebtedness in developing countries. The same findings apply when we use EVI's components rather than EVI itself. This result of EVI is confirmed when the analysis is performed over decades.
- For LICs, the analysis performed on time series over the entire period shows neither a significant effect of EVI on the total public debt, nor a nonlinear relationship between EVI and the total public debt. However, over decades, we find evidence of a nonlinear relationship in the form of U curve between EVI and the total public debt. When turning to EVI's components, we observe that:

- the insignificant effect obtained of the EVI on the build-up of the public debt hides the fact that LICs' exposure to shocks affects positively and significantly their accumulation of total public debt.
- the size of shocks and that of the exposure to shocks in LICs are non-linearly related to the accumulation of public debt by these countries and, their impact on the public debt depends on the size of each of these EVI's components.

- Regarding both sub-samples of LMICs and UMICs, the results are suggestive of a non-linear relationship in the form of a 'U' curve between EVI and the total public debt. When the model is estimated over decades, such results are confirmed only for UMICs, but not for LMICs where there is no nonlinear relationship between EVI and the public indebtedness. Considering EVI's components, while we obtain a non-linear relationship between EVI's components and the total public debt for UMICs, such relationship is observed only for the 'exposure' variable in the case of LMICs.

These results suggest that, as for economic growth and other macroeconomic indicators, structural vulnerability also matters seriously for indebtedness in developing countries, particularly in LICs where the effect appears to be very strong. Given the development challenges faced by developing countries and particularly LICs, the repeated experience of structural shocks will likely reduce their ability to develop appropriate policy and institutional responses to further shocks. Accordingly, there is a need for the international community and particularly the Bretton Woods Institutions (the International Monetary Fund – IMF - and the World Bank) to take into account the structural vulnerability of developing countries (especially LICs) in designing appropriate development policies, especially those related to debt sustainability.

Appendix

Appendix 1: The List of samples and sub-samples

The Sample of Developing Countries: List of the 97 Developing Countries used in this study according to the World Bank Classification

Algeria, Angola, Argentina, Bangladesh, Belize, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Republic of Congo, Costa Rica, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Islamic Republic of Iran, Jamaica, Jordan, Kenya, Lao PDR, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Senegal, Seychelles, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Syrian Arab Republic, United Republic of Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, Uruguay, Republic of Vanuatu, Venezuela, Viet Nam, Yemen, Zambia, Zimbabwe.

The Sub-sample of Low-Income Countries (LICs): List of the 33 LICs used in this study according to the World Bank Classification

Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Democratic Republic of the Congo, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Kenya, Lao PDR, Liberia, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Rwanda, Senegal, United Republic of Tanzania, Togo, Uganda, Viet Nam, Yemen, Zambia, Zimbabwe.

The Sub-sample of Lower-Middle Income Countries (LMICs): List of the 35 LMICs in this study according to the World Bank Classification

Angola, Belize, Bolivia, Cameroon, China, Republic of Congo, Côte d'Ivoire, Djibouti, Ecuador, Egypt, El Salvador, Guatemala, Honduras, India, Indonesia, Islamic Republic of Iran, Jordan, Lesotho, Maldives, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Thailand, Tunisia, Republic of Vanuatu.

The Sub-sample of Upper-Middle Income Countries (UMICs): List of the 29 UMICs used in this study according to the World Bank Classification

Algeria, Argentina, Botswana, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Fiji, Gabon, Jamaica, Lebanon, Malaysia, Mauritius, Mexico, Namibia, Oman, Panama, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, South Africa, Suriname, Turkey, Uruguay, Venezuela.

CHAPTER IV[47]: Structural vulnerability and excessive public indebtedness in CFA Franc Zone Countries

Abstract

This chapter relies on the 'institutional debt rule' implemented in Franc Zone countries to assess whether the structural vulnerability of these countries matter for their probability to enter into excessive indebtedness. This structural vulnerability is measured by retrospective 'Economic Vulnerability Index' (EVI) recently computed jointly by the United Nations and Guillaumont and Cariolle (2011). We observe evidence that the impact of 'EVI' is non-linear with respect to the probability of these countries to engage into excessive indebtedness and that, this effect appears to be the same for the two monetary areas belonging to the CFA Franc Zone countries: a rise of EVI induces a higher probability of excessive debt and for higher EVI, this probability declines. Consequently, international development institutions such as the Bretton Woods should take into account such vulnerability in their assessment of the adequate development policies and recommendations to these countries.

Keywords: Structural Vulnerability; Public debt; unconditional logit model; linear probability model.

JEL Classification: E60; H63; O10 ; C33 ; C35.

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1. Introduction

The issue of conducting fiscal policy in a monetary union is longstanding. Fiscal discipline and fiscal restructuring in a monetary area have been the subjects of many theoretical and empirical studies in the developed world, particularly in the European Union. For example, many studies have been conducted on the determinants of excessive deficits in the euro area (e.g. Bayar, 2001; Bayar and Smeets, 2009; Castro, 2007; Tiryaki, 2008; Huges-Hallet and Lewis, 2004, 2005). However, to our knowledge, such topics have been scarcely explored in the context of African monetary unions such as the CFA[48] Franc Zone. This study aims to fill this gap.

The CFA Franc Zone was created in 1945 during the Bretton Woods agreement and it currently comprises 14 Sub-Saharan African countries that belong to two separate monetary areas: WAEMU (West African Economic and Monetary Union) and Economic Community of Central African States (ECCAS). These countries are also classified as the most vulnerable developing countries to natural and external shocks (see Guillaumont, 2009, 2011).

The present chapter investigates whether this vulnerability of CFA Franc Zone countries matters for their public indebtedness. In other words, we rely on the budgetary institutional criteria (especially related to debt) set up in 1999 by WAEMU member countries and adopted by the end of 2001 by ECCAS members to explore whether the structural vulnerability of these countries matters for their excessive debt.

The remainder of the chapter is organized in the following way. Section 2 presents a brief overview of the institutional arrangements of the CFA Franc Zone's monetary unions. Section 3 summarises the state of the literature on the definition and measurement of the concept of 'economic vulnerability' in order to derive our vulnerability index. Section 4 is devoted to some data analysis. Section 5 reviews the literature on debt sustainability, - since the setup of the institutional debt rule within the CFA Franc Zone aims at helping countries maintain a sustainable path of their public debt -, and sets the stage for the model used. Section 6, based on Section 5, describes the empirical model and discusses the expected signs of the variables and the econometrics technique. Section 7 presents the empirical results and Section 8 concludes.

[48] CFA was defined as 'Communauté Française d'Afrique', but is now known as 'Franc de la Communauté Financière d'Afrique' for WAEMU area and 'Coopération Financière en Afrique Centrale' for ECCAS area.

2. Institutional arrangements of CFA Franc Zone countries

Of the 14 Sub-Saharan African countries in the CFA Franc Zone, 12 were once French colonies. Formally, these countries belong to two separate monetary areas (WAEMU and ECCAS) and share two single currencies that hold the same acronym, the CFA Franc. Thus, the CFA Franc is issued and managed by two regional central banks: the Central Bank of West African States (known as *BCEAO* in French) and the Central Bank of Central African States (known as *BEAC* in French). These two CFA Francs were by design initially pegged at the same rate to the French Franc in 1948, and since 1999 to the Euro, following the creation of the euro area. Since the inception of the CFA Franc Zone, the French Treasury has guaranteed an unlimited convertibility of the CFA currencies and participated on the executive boards of the two regional central banks. The counterpart of this guarantee has been the obligation of each central bank to maintain a proportion of its official reserves (50% for *BCEAO* and 65% for *BEAC*) in an operation account at the French Treasury.

In line with the adoption by the European Union of the Maastricht treaty[49] in 1992, and recognising the crucial role of fiscal policy management in achieving macroeconomic stability, sustainable growth and macroeconomic convergence, both WAEMU and ECCAS have adopted a set of measures. In 1999, WAEMU member countries adopted a regional 'Convergence, Stability, Growth and Solidarity Pact', which defines a set of primary and secondary convergence criteria pertaining to public finance, the real sector, the balance of payments and common currency (the list of these criteria can be found in Adedeji and Williams, 2007 or the 'Note d'information n°127 of Banque de France[50], 2010'). ECCAS, following the establishment of a multilateral committee in 1993, adopted by the end of 2001 a framework of convergence criteria that comprises the same primary criteria as WAEMU. Accordingly, the two monetary areas share a set of primary criteria within the CFA Franc Zone. However, while a directive imposes sanctions against a WAEMU country's non-compliance of a primary convergence criterion, such a sanction measure does not exist for ECCAS. The primary criteria include:

[49] This treaty comprises a set of rules reinforced in 1999 within the framework of the stability and growth pact for countries in the Economic and Monetary Union.

[50] This note can be found at http://www.banque-france.fr/fileadmin/user_upload/banque_de_france/Information_diverses/infoetlib/note127.pdf.

- The ratio of the basic fiscal balance to nominal GDP must be in balance or in surplus.
- The ratio of outstanding domestic and foreign debt to nominal GDP must not exceed 70%.
- Average annual inflation rate cannot exceed 3% a year.
- The non-accumulation of domestic and external arrears.

The institutional debt rule is the core of our study. This rule, by constraining CFA Franc Zone countries to maintain their public debt under the threshold of 70%, acts as a debt sustainability rule. This is why Section 5 draws on the literature on debt sustainability to build the presented empirical model. Section 3 reviews the state of the literature on the definition and measurement of 'economic vulnerability'.

3. The concept of 'economic vulnerability'

3.1 A literature review on the definition of 'economic vulnerability'

The concept of 'vulnerability' refers to that of 'risk'. There are several definitions associated with the concept of 'risk' depending on the disciplines where it is studied. Generally, vulnerability can be seen as the risk that a 'system' undergoes from negative change due to a 'perturbation' (see e.g. Naudé et al., 2009).

In economics, vulnerability is either associated with poverty where the concern is the risk of households falling into or remaining in poverty, or natural hazards and macro-level shocks where the concern is how the hazards adversely affect a country or region's economy (see e.g. Naudé et al., 2009). Guillaumont (2009) highlights that the first type of vulnerability can be derived from the second one. We focus in this chapter on the second kind of vulnerability: the 'economic or structural vulnerability'.

The issue of 'economic vulnerability' was really raised for the first time (in 1990) by the Maltese Ambassador, his Excellency Ambassador Alexander Borg Olivier[51] (see Maltese Government, 1990:7). Since then, many conceptual and empirical studies[52] have been conducted on that issue. More specifically, Briguglio (e.g. 2004), Briguglio and Galea (2003), Cordina, (2004a, b) and Briguglio et al., (2008) define economic vulnerability as a country's

[51] He was the Permanent Representative of Malta to the United Nations.

[52] The conceptual and empirical viewpoints of economic vulnerability are well documented in the literature (see e.g. Atkins et al., 2000; Briguglio 1995; Briguglio and Galea, 2003). Cordina and Farrugia (2005) also provide a summary on the measurement issue of the concept of 'economic vulnerability'.

proneness to exogenous shocks lying outside their control or a proneness to increased susceptibility of such a country to the adverse effects of these shocks'.

In the same vein, several studies of Patrick Guillaumont (see e.g. Guillaumont, 2009; Guillaumont and Cariolle, 2011) have been conducted on the issue of 'economic vulnerability' where he defines 'the economic or structural vulnerability of a country as the risk of a (poor) country seeing its development hampered by the natural and external shocks it faces'. Two main types of exogenous shocks (in other words, two main sources of vulnerability) are therefore considered:

- the environmental or 'natural' shocks which encompass, for instance, natural disasters (earthquakes, volcanic eruptions) and the more frequent climatic shocks (typhoons, hurricanes, droughts, floods, etc);
- external (trade-and-exchange-related) shocks which comprise, for instance, slumps in external demand, world commodity price instability (and correlated instability of terms of trade), international fluctuations of interest rates, and so forth.

Other domestic shocks such as unforeseen political changes are thus excluded from being exogenous.

Meanwhile, all these authors highlight the difference between the concept of 'economic vulnerability' and that of 'economic resilience'. For example, Briguglio (2008) defines the resilience as the policy-induced ability of an economy to recover from or adjust to the negative impact of adverse exogenous shocks and to benefit from positive shocks. Thus defined, economic resilience may take the form of higher savings and investments which may occur in the wake of pronounced uncertainty and may enable small island states to achieve high levels of economic development (Cordina, 2004a,b). Guillaumont (2009) considers economic resilience as the capacity of a country to react to shocks. He underscores that this resilience depends more on current policy, is more easily reversed, and is less structural but may also comprise a structural element[53].

Briguglio (2003) develops the notion of the 'Singapore Paradox', according to which many small island states, in spite of their economic vulnerability, manage to generate a relatively

[53] According to Guillaumont (2009) a distinction close to this three components is given in Rodrik (1999) who, in looking at the risk of social conflict in countries facing external shocks, considers the individual severity of the shocks, the depth of latent social conflict (likely to increase the impact of the shocks), and the quality of conflict management institutions.

high GDP per capita when compared to other developing countries. To explain this phenomenon, Briguglio and Galea (2003) and Briguglio and Kisanga (2004) take the case of Singapore which experiences high rates of economic growth and high GDP per capita despite its high exposure to external shocks. Hence, the 'Singapore Paradox' stems from the juxtaposition of economic vulnerability and economic (nurtured) resilience, where economic vulnerability was confined to inherent features which are permanent or quasi-permanent, while economic resilience was associated with man-made measures which enable a country to withstand or bounce back from the negative effects of external shocks.

3.2 A literature review on the measurement of economic vulnerability

In line with the definitions of economic vulnerability provided above, we summarise here the different measures of that concept. The propositions of vulnerability indices have mainly focused on the quantification of the special features of the countries by relying on indicators such as economic openness, export concentration, dependence on imports of energy and peripherality. Other approaches attempt to measure vulnerability in terms of the phenomenon, namely the variability of output and similar indicators.

The first vulnerability index was proposed by Briguglio (1993) and is composed of three variables: the exposure to foreign economic conditions, insularity and remoteness, and proneness to natural disasters. This index has been the subject of several modifications in 1995, 1997, and updated by Briguglio and Galea in 2003. Other authors such as Chander (1996) and Wells (1996) follow the methodology adopted by Briguglio (1995) and propose a vulnerability index which remains to a certain extent in line with Briguglio (1997)'s. Wells (1997) revised its measure of vulnerability and uses a methodology that departs from the previous ones by relying on the idea that 'vulnerability manifested in instability in economic growth'. He then uses regression analysis to build its index. Atkins et al. (1998) also adopts the econometric analysis and show evidence that economic vulnerability captured by 'output volatility' depends mainly on the export dependency ratio, the merchandise export diversification and the vulnerability to natural disasters. Crowards (2000) also contributes to that literature by suggesting an index of economic vulnerability for developing countries which is similar to the previous ones, but is rather composed of more variables. In line with Wells' (1997) study, the Committee for Development Policy (CDP)[54] (2000) of the United

[54] This committee was previously called Committee for Development Planning.

Nations (UN) developed a composite index in order to identify the causes of vulnerability of least developed countries (LDCs). By capturing vulnerability through economic growth instability, this index is a weighted average of five variables, namely the share of manufacturing and modern services in GDP, merchandise export concentration ratio, instability of agricultural production, instability of exports of goods and services and population size. The weights are obtained through an econometric analysis where the impact of each economic indicator quoted above on economic growth is examined. All these studies convey the same message according to which small states are inherently more vulnerable. However, Gonzales (2000) criticizes these studies, arguing that their results lead to considerable variations and contradictions due to the differences of the parameters and the methodologies employed by them.

Following the renewal growing concern over macroeconomic vulnerability of least developed countries and the demand of these countries to build an adequate vulnerability indicator which should be taken into account in the design of international development policies, the CDP has developed and progressively refined, after successive revisions (2003, 2006 and 2009) an economic vulnerability index which captures vulnerability caused by structural factors. The structural economic vulnerability employed in this study referred to the so-called 'retrospective Economic Vulnerability Index (EVI)' jointly calculated on an annual basis by the FERDI[55] (see Cariolle, 2011; Guillaumont and Cariolle, 2011) with the UN/United Nations Department of Economic and Social Affairs (DESA). This indicator covers 128 developing countries over the period 1975–2008 (unbalanced panel data) and has the advantage of being simple, transparent and parsimonious. Moreover, several multilateral development banks are exploring whether to move from their traditional indicator to EVI for aid allocation (see Guillaumont, 2011, for more details).

This 'economic vulnerability' is a result of three components: (i) the size and frequency of the exogenous shocks, either observed (ex post vulnerability) or anticipated (ex ante vulnerability); (ii) exposure to shocks; and (iii) the capacity to react to shocks, or resilience. Therefore, *structural vulnerability* (that is, the EVI), which results from factors that are independent of a country's current political will is different from the *vulnerability deriving*

[55] FERDI is the 'Fondation pour les Etudes et Recherches sur le Développement International'. The method of retrospective EVI's calculation can be found in details in Cariolle (2011) and descriptive statistical analysis on the retrospective EVI can be found in Guillaumont (2011), and Guillaumont and Cariolle (2011). This is why we do not find it useful to replicate this statistical analysis here and refer the readers to those articles.

from policy, which results from recent policy choices. In other words, an index of structural economic vulnerability is related to structural factors—not policy factors—that are beyond the present control of the country and which also influence global vulnerability, mainly through resilience (Guillaumont, 2009). This structural vulnerability index is a composite index of 'shocks' and 'exposure to shocks'; both indicators are equally weighted[56]. We display below the structure of the retrospective EVI (henceforth, EVI) where the weights of indices are in brackets.

Structure of the EVI

- Exposure Index (50%)
  - -Smallness (50%)
  - -Location Index (Remoteness) (25%)
  - -Specialization Index (Merchandise Export concentration and share of agriculture, forestry and fisheries) (25%)
- Shock Index (50%)
  - -Natural Shock Index(Homelessness due to natural disasters; instability of agriculture production) (50%)
  - -Trade Shock Index (Instability of exports of goods and services) (50%)

Source: Guillaumont et al. (2011)

4. Data analysis

Our study covers a sample of 14 CFA Franc Zone countries[57] over the period 1980–2008. Within this group, eight countries belong to WAEMU[58] and six to ECCAS[59]. Graph 1 in the Appendix compares the evolution of average total public debt with the average economic vulnerability index (EVI) for CFA Franc Zone countries. This graph suggests a strong correlation between average EVI and average total public debt over time.

Graph 2 illustrates the cumulative frequency distribution of the duration of 'non-excessive debt' spells over the full sample of CFA Franc zone countries. This analysis provides an insight into the durations of 'non-excessive debt' spells for this monetary zone. The spell refers to the concept used in the "duration" or "survival" or "hazards" analysis to study the

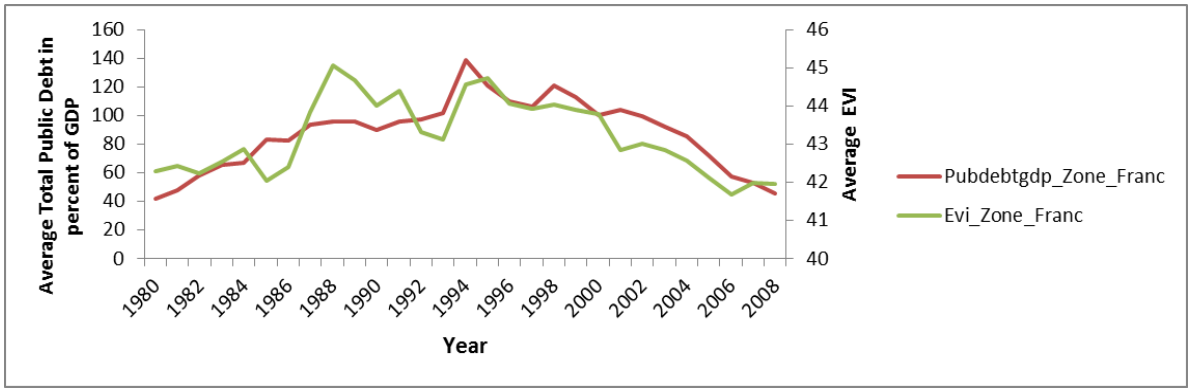
[56] See for example Guillaumont and Cariolle (2011) for a discussion on the weight of indicators.
[57] Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Gabon, Guinea-Bissau, Mali, Niger, Senegal and Togo.
[58] WAEMU countries include Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.
[59] ECCAS include Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon.

length of the time spent by individual (in our case, a country) within a given state. Hence, the "spell length" represents the "time to event" or "time failure". In this chapter, the 'non-excessive debt' spells length indicates the time spent by a given CFA Franc Zone country within the state of 'non-excessive debt' (i.e., before entering 'excessive debt'). 'Non-excessive debt' spells are computed as follows:

- We first use a dummy variable 'dummy non-excessive debt' which takes the value 1 if for a given CFA Franc Zone country, the debt-to-GDP ratio is lower than 70% and 0, otherwise.
- From that variable, we construct a duration variable – that is, the 'non-excessive debt spells' - associated with each country - which represents the time spent within the state of 'non-excessive debt' (i.e., before entering 'excessive debt').
- Next, we construct the cumulative frequency graph of that duration variable over the full sample of CFA Franc Zone countries (see Graph 2).

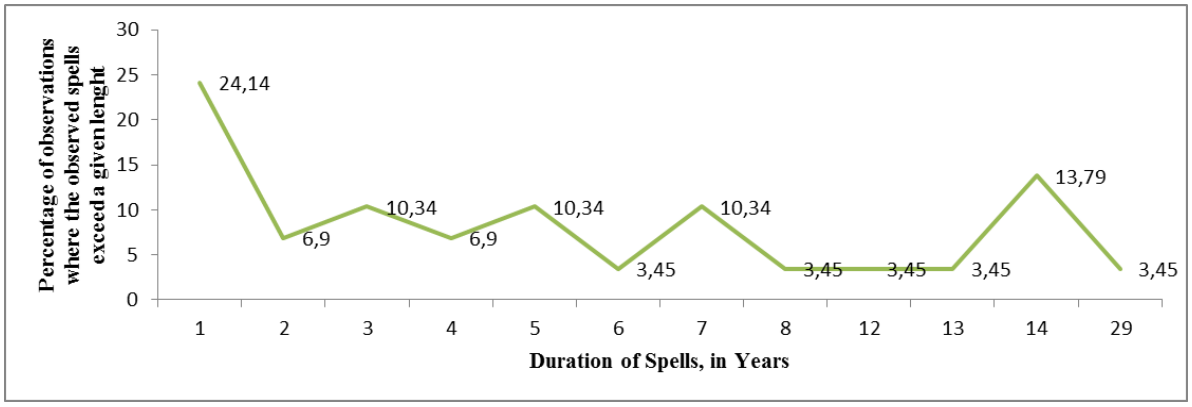
In fact, we plot the observed spell lengths on the x-axis and the proportion of observations where the observed spell of non-excessive debt exceeds a given length, on the y-axis. Note that of the total of 50 spells, there are 21 spells of 'excessive debt', representing 42% of all spells.

Graph 1: Comparative evolution of the Average Total Public debt and Average EVI of CFA Franc Zone Countries



Source: The Author Calculation based on IMF's data on Public Debt.

Graph 2: The empirical distribution of the Duration of 'Non-Excessive Debt Spells' in CFA Franc Zone countries



Source: The Author calculation is based on IMF's data on Public Debt. Figures in the graph represent the percentage of spells duration until the entry into excessive debt state in CFA Franc Zone where the observed spells exceed a given length.

Graph 2 also suggests for the CFA Franc Zone that among the spells of non-excessive debt and over the period 1980–2008, 24.14% enter into a state of "excessive debt" after the first year of non-excessive debt. After five years, more than half (58.6%) of the spells enter into a state of 'excessive debt'. The figure is approximately 76% after 8 years and approximately 96.55% after 14 years. Note that no spell lasts between 9 and 11 years and between 15 and 28 years. In addition, only one spell lasts 12 years, one, 13 years, four spells last 14 years and finally only one lasts 29 years. We can thus conclude that whereas a small proportion of spells of 'non-excessive debt' are long-lasting, the most important 'non-excessive debt' spells last only a few years. Thus, CFA Franc Zone countries seem to display a high tendency to enter an 'excessive debt' state. Section 5 presents the traditional accounting mathematical model of the sustainability of public finances.

5. Sustainability of public finances

Since the purpose of our study is to examine the effect of economic vulnerability on the total public debt, we start with the standard public finances sustainability model and then derive the appropriate model that will help us perform our regressions. Although there is no consensus among economists regarding the public debt threshold that maintain the public debt path

sustainable, the empirical literature distinguishes between three main approaches[60] used to assess the public debt sustainability. These approaches have been discussed in IMF (2003) (see also Vera, 2009).

The first and most common approach starts from the basic accounting identity (or Domar's approach) and links the changes in the debt stock to public sector revenues and expenditures. According to this approach, fiscal policy is sustainable if it delivers a stable ratio of public debt to GDP. In other words, if the actual primary balance is less than the debt stabilizing balance, current fiscal policy that implies an increasing ratio of public debt to GDP is viewed as unsustainable. This approach allows calculating the so-called "debt stabilizing primary balance" which is the primary balance that would make the debt-to-GDP ratio stable. Hence, the degree of the needed fiscal adjustment stems from the difference between the actual and debt stabilizing primary balance. The second approach (a more flexible one) refers to the called Present-Value Constraint (PVC) approach. It assesses the debt sustainability within the context of the broader objectives and constraints of the fiscal policy decision-making process. For example, it consists in estimating fiscal policy reaction functions where the relationship between fiscal policy instruments and fiscal policy objectives (such as the stabilization of output fluctuations, the maintenance of debt sustainability) is examined. Hence, if the primary balance responds positively to public debt, this generally implies that fiscal policy is consistent with long-run solvency (see Bohn, 1998). The third approach to assessing public debt sustainability is to examine whether the government is "overborrowing", that is, its debt stock is higher than the present discounted value of its expected future primary surpluses.

However, irrespective of the conceptual approach adopted, the fundamental block of the fiscal sustainability corresponds to a simplification of the government budget constraint (Vera, 2009).

We first assume that the government finances its deficit only by issuing debt. Hence, we exclude for the moment other financing items such as seigniorage revenue, privatization proceeds, and the sales of public assets.

[60] Note that the World Bank and IMF have in the last few years defined the concept of public finance sustainability (or 'debt sustainability' according to their used expression) as in first time, a group of indicators and lately as a set of threshold (see IMF, 2002a).

Let us denote B_t the stock of the public debt at the end of the year t; i_t the nominal interest rate on total public debt; G_t and T_t are respectively the total tax revenue and the total government consumption (excluding interest payments on the total public debt).

The government budget constraint is given by:

Debt in period t = (Debt in period t-1) + (Primary Deficit +Interest Payments on public debt), that is:

Debt in period t - (Debt in period t-1) = Primary Deficit +Interest Payments on public debt = Primary Deficit (in year t) + i_t*(Debt for period t-1).

In other words, this equation can be rewritten as:

$$(B_t - B_{t-1}) = (G_t - T_t + r_t B_{t-1}) \quad \textbf{(1)}$$

To analyze the evolution of the total public debt, we need to normalize the public debt by some measure of the country's ability to service and repay its debt: the most common choice is typically the nominal Gross Domestic Product, denoted Y_t. Thus, the evolution of the debt-to-GDP ratio could be obtained by analyzing the derivative (Δ) of $\frac{B_t}{Y_t}$:

$$\Delta(\frac{B_t}{Y_t}) = \frac{\Delta B_t}{Y_t} - \frac{B_t}{Y_t}\frac{\Delta Y_t}{Y_t} \quad \textbf{(2)}$$

If we call $b_t = \frac{B_t}{Y_t} = \frac{B_t}{p_t y_t}$ and apply $\frac{\Delta Y_t}{Y_{t-1}} = g_t + \pi_t(1+g_t)$ where $\pi_t g_t \approx 0$, the expression (2) can be rewritten as:

$$\Delta b_t = \frac{\Delta B_t}{Y_t} - b_t(\pi_t + g_t) \quad \textbf{(3)}$$

where π_t stands for the inflation rate and g_t for the real GDP growth. The substitution of (3) into (2) leads to: $\Delta b_t = \frac{G_t - T_t + rB_{t-1}}{Y_t} - b_t(\pi_t + g_t)$ **(4)**

By defining $\phi = \frac{G_t}{p_t y_t}$, and $\tau = \frac{T_t}{p_t y_t}$, then we obtain in terms of ratios to GDP:

$$\Delta b_t = (\phi - \tau) + \frac{rB_{t-1}}{p_t y_t} - b_t(\pi_t + g_t) \quad \textbf{(5)}$$

By supposing that the debt ratios are steady state and that the real rate of interest on debt is given by $i = r - \pi$, the rearrangement of (5) leads to:

$$\Delta b_t = (i - g)b_{t-1} - (\tau - \phi) \quad \textbf{(6)}$$

The equation (6) shows that if the primary surplus ratio is equal to zero, the debt-to-GDP ratio will grow or shrink at the rate $(i - g)$, within the framework where we assume that there is a level beyond which the debt-to GDP-ratio cannot or should not rise. Under this situation, the public debt ratio increases when the real effective interest rate on government debt exceeds the growth rate of GDP (that is, when the growth-adjusted real effective rate is positive) unless there is a sufficient amount of primary budget surplus. In other terms, the Domar's condition for debt stability (and thus fiscal sustainability) can be held when the real GDP growth rate is higher than the real interest rate, even if the primary balance continues to be just zero.

To estimate the effect of structural economic vulnerability on public debt in CFA Franc Zone countries, we rely in this chapter on the mathematical model of fiscal sustainability underlying that fundamental block.

6. Model specification

In the previous model of fiscal sustainability, we assume that the budget deficit is financed only by debt creation. We now relax this hypothesis and consider the additional financing items that can add to government revenue (non-tax revenues) such as seigniorage revenue, privatization proceeds, and the sales of public assets. To take into account such items in the equation (1), we define the primary balance not as the difference between tax revenue and the government spending, but rather as the difference between the overall government revenue (excluding grants) - comprising several items (non-tax revenue) - and non interest (primary) expenditure.

Our model relies thus on the equation (1) augmented with our variables of interest (the EVI or its components), and other control variables which are likely to influence both the variables of interest and the dependent variable (the overall public debt).

We first present our model specification and discuss the expected signs of the covariates and finally the econometric technique.

6.1 The model specification

In this sub-section, we describe the model that allows us to examine the effect of the structural vulnerability of CFA Franc Zone countries in their probability of excessive indebtedness. More specifically, the model examines the probability of a country breaching the 70% of GDP debt rule (that is, leading to excessive public debt). The structural model is stipulated as follows:

$$\begin{cases} y_{it}^{*} = x_{it}^{'}\beta + \varepsilon_{it} \\ y_{\mathrm{it}} = 1 \text{ if } y_{it}^{*} > 70\%, \text{ and } y_{\mathrm{it}} = 0 \text{ if } y_{it}^{*} <= 70\% \end{cases}$$

where i = 1,…N =14, denotes the country index and t = 1980-2008, denotes the period (year) index; y^{*} is an unobserved outcome; y_{it} represents the excessive debt status: $y_{it} = 1$ if in a country i of the CFA Franc Zone at the year t, the government incurs an excessive public debt, that is, its total debt-to-GDP ratio is equal to or higher than 70%; $y_{it} = 0$, otherwise. The vector x_{it} represents the structural economic vulnerability variables (that is, the EVI or its components) as well as a set of other control variables which act as (economic) resilience-related variables which are supposed to influence the impact of EVI on the probability of excessive debt. These variables include the fiscal balance (in percentage of GDP), the real GDP growth rate, the terms of trade, the real effective exchange rate, the grants (as a percentage of GDP), the inflation rate (captured here through the GDP deflator), and a dummy variable representing the period since the entrance into force of the ‘‘Pact of Convergence, Stability, Growth and Solidarity’’ within the zone franc. The definition and the source of these variables are provided in the Appendix 1. ε_{it} is an error term.

6.2 Discussion on the expected signs of the explanatory variables

Before starting the discussion of the expected effects (signs) of our explanatory variables, let us highlight one important pitfall regarding both the linear and the nonlinear model. Indeed, for the model’s parameters to be consistent and efficient, our regressors should be predetermined with respect to the dependent variable. In our case, to avoid any suspicion of endogeneity issue related to the simultaneity bias between certain regressors and the dependent variable, we use in the model where it appears necessary the lagged values of the explanatory variables (especially for the variables ‘fiscal balance’, ‘real economic growth’, ‘inflation’, grants-to-GDP ratio’ and ‘real effective exchange rate’). While this precaution

could at least mitigate the simultaneity bias in any model like ours, in our specific case, the dependent binary variable is defined by institutional rules rather than by economic variables. As a result, there is likely no simultaneity bias and, the endogeneity issue will not thus be a problem. Nevertheless, to take into account such eventual problem along with the delay in processing some economic data, we do consider the previously quoted one year lagged variables in our different model specifications.

Now what about the expected effect of each explanatory variable?

The EVI's variable

In analyzing the effect of economic vulnerability on economic growth, Cordina (2004a, b) shows that increased risk can adversely affect economic growth as the negative effects of downside shocks would be commensurately larger than those of positive shocks. Furthermore, he presents a conceptual application of the "Singapore Paradox" approach and shows evidence that in response to a situation of vulnerability, saving and capital formation in an economy can be important sources of resilience. Guillaumont (2009) also discusses the effects of the (retrospective) EVI on economic growth and poverty and concludes that the EVI reduces economic growth and, through the latter, exerts deleterious effects on the pace of poverty reduction. These impacts occur through the channels of export earnings instability, the primary instabilities (especially through their effects on public finances or via the passed through of price fluctuations to producers), political instability, the smallness of the country, the structure of the economy and the location of the country.

More recently, Ferrarini (2009) re-assesses the analysis underlying the New Debt Sustainability Framework (NDSF) endorsed by both the Bretton Woods Institutions (the IMF and the World Bank) - which guides the borrowing decisions of Low-Income Countries. This re-evaluation consists in testing the significance and the reliability of the World Bank's CPIA or the governance indicators as predictors of debt distress episodes across LICs. He obtains strong evidence that factors of illiquidity and structural vulnerability[61] are more suitable predictors of the occurrence of debt distress episodes across Low-Income Countries (LICs). Thus, by challenging the NDSF prospects whose aim is to solve the long-standing debt crisis involving many of the LICs, the author concludes that "the NSDF is bound to distort aid

[61] The Economic Vulnerability Indicator (EVI) used is that of United Nations Department of Economic and Social Affairs – Division of Sustainable Development.

allocation away from the country-specific circumstances which truly matter for the achievement of debt sustainability".

In our case, we argue the following: the structural vulnerability, by reducing tax revenue (unless the government increases taxes after an exogenous shock or when its exposures to shocks rises, though such measure is politically sensitive and difficult to implement) and increasing government spending is expected to increase the budget deficit. We hypothesise that, irrespective of its effect on the public finances (the budget balance), the structural vulnerability of a country is expected to increase its public indebtedness and thus to raise the probability of excessive indebtedness (especially in the case of CFA Franc Zone countries). However, one can think that when a government experiences a higher structural vulnerability of its economy, instead of borrowing even at low cost to cope with the additional financial needs induced by such rise in structural vulnerability, it can rely on non-costly financial means such as the privatisation proceeds, the seigniorage[62] and the sale of its assets (buildings, infrastructure, mineral deposits, and various forms of liquid reserves) (Vera, 2009). In such cases an obtained positive effect of EVI on the accumulation of public debt or on the probability of excessive debt may cancel out the effect of the fiscal balance (the coefficient of the variable capturing the 'the fiscal balance' may not be statistically significant), since in the latter, we include tax revenue as well as other forms of non-tax revenues.

One can also think that countries facing structural vulnerability benefit from (temporary) debt forgiveness from their creditors, the extra revenues are used to cope with the shocks. In such situation, we can observe in the regressions a statistically significance of both the coefficient of the fiscal balance and that of the EVI.

We also conjecture that there exists a nonlinear (in the form of curve-linear or inverted U-shape) relationship between EVI/or its components and the probability of excessive debt and that, whether the membership of a CFA Franc Zone country to WAEMU or ECCAS matters for such non-linearity. The hypothesis underlying the inclusion of both the 'EVI'/or its components and the square of EVI/or the square of its components is the following: When facing a rise in their vulnerability stemming either from exposure increases or shocks rises, or

[62] Note however that only the ECCAS countries can use seigniorage to finance their deficits, as this measure is forbidden in WAEMU area.

both, a CFA Franc Zone country has several options apart from resorting to indebtedness to accommodate the additional costs induced by a such rise in structural vulnerability: the first option is to adjust its fiscal policies by either increasing taxes or reducing public spending or adopting both measures (taxes rise and expenditures reduction), although, as we mention above, these measures could be politically difficult to implement; the second option consists on using the non-costly means of financing (previously quoted) that are available to them. Note however that only the ECCAS countries can use seigniorage to finance their expenditures as this measure is forbidden in WAEMU area. The third option is for these countries to seek for debt relief granted by the creditors.

Therefore, we can have two main expectations regarding the nonlinearity of the EVI with respect to the probability of excessive debt in CFA Franc Zone countries:

Hypothesis 1: we expect the public debt not to be affected or even to be reduced in the first stages of EVI increases (in the cases of fiscal adjustment or drawing on non-costly means of financing or debt relief), but as EVI becomes higher, these countries will have no choice but to resort to domestic and/or external debt. As a result, we expect a positive sign of the variable 'EVI square' (or the square of the components) and a negative sign of the coefficients associated to 'EVI' or its components. These coefficients may be statistically insignificant.

Hypothesis 2: we also expect the likelihood of excessive public debt to rise in the first stages of EVI (if the countries choose to borrow internally or abroad to accommodate the EVI increases) and then to decline for higher EVI, because of the debt relief granted by creditors or the use of non-costly financial resources or also the adoption of fiscal adjustment measures. Hence, the sign of 'EVI' or its components will be positive and that of its square or its components' square will be negative.

The fiscal balance: as mentioned above, we expect an improvement in the fiscal balance to reduce the overall public debt and thus the probability of excessive debt. If the EVI (or its components) effect translates through the fiscal balance, the impact of the latter on public debt will be statistically nil. However, we acknowledge that a statistically nil effect of fiscal balance may not necessarily be due to the presence of the EVI or its components in the model, but may also be explained by the effect of other control variables of the model that influence the fiscal balance (e.g. economic growth; the terms of trade).

The real GDP growth

The indebtedness of a country is expected to rise following losses in output, that is, lowering of real GDP growth (see also Barro, 1979). Accordingly, the real GDP growth is expected to be negatively associated with the build-up of public debt and accordingly, with the likelihood of excessive debt.

The real effective exchange rate

The real effective exchange rate (REER) indicates a country's competitiveness. In our case, a rise in the REER means an appreciation and a decline means depreciation. The effect of the real effective exchange rate on the overall public debt of a country depends on its effect on the domestic and external debt.

Regarding the domestic debt, on the supply side, its issuance may be easier to countries when the currency is appreciating because the expected appreciation allows prudent policymakers to hide the implicit insurance premium embedded in domestic currency borrowing (Caballero and Cowan, 2006; Panizza et al., 2011). On the demand side, a real appreciated exchange rate is, at any given interest rate, likely to discourage the demand of domestic currency bonds as investors may foresee an ex-post appreciation of the foreign currency rate (a real depreciation of local currency) (see also Panizza et al., 2011). Furthermore, in terms of valuation effects, a real effective exchange rate appreciation (depreciation) automatically induces a higher (lower) domestic indebtedness of the government.

With respect to the external public debt, the effect of REER changes on its build-up is also ambiguous. In fact, a real exchange rate depreciation will lead to a declining of the external debt stock if the induced rise in export earnings of this depreciation is sufficiently enough to service the external debt; otherwise, the depreciation of the REER will result in a rise of external indebtedness (Craigwell et al., 2010; see also Ng'eno, 2000), and hence the likelihood of excessive debt.

Overall, we cannot conclude a priori about the effect of REER changes on the probability of excessive debt.

The terms of trade

An improvement in terms of trade (an increase in the relative price of exportables for a country) is likely to increase the export (foreign) revenues of the beneficiary country, reduce

current expenditures and therefore improve the fiscal balance. Note that the reduction effect of public expenditures owe to the terms of trade improvement appears through a relative decline in the price of inputs (in the cases where imports represent an important share of expenditures - which is usually observed in many developing countries and a fortiori, in CFA Franc Zone countries). Furthermore, such improvement in terms of trade, by increasing the economic growth may also reduce the need for social assistance from government and in fine, add to the reduction of current expenditures. Thus, an improvement in terms of trade is expected to be positively related to lower external and /or domestic borrowing and by the same token, to a low probability of excessive debt.

Conversely, a decline in terms of trade, by lowering revenue, increasing (substantially) public spending and thus worsening the fiscal balance, will likely result in higher total public debt. As a result, the likelihood of excessive debt will rise. The positive effect of such terms of trade deterioration on public expenditures translated through for example, the rise of social assistance needs, and the high demand by public enterprises of support from the government because they cannot adjust their pricing policies to changes in export and import prices.

The grants

According to Cline (2003), in low-income countries (LICs), the grants elements (foreign grants, which represent a substantial fraction of GDP), are available to pay some part (or all) of the interest due on debt, and can consequently modify our previous debt sustainability. This is why we include in our model specification the foreign grants as a percentage of GDP. We thus expect the grants to alleviate the burden of indebtedness of developing countries—that is, to exert a negative effect on chance of entering into excessive debt. But we can also hypothesise that the higher the grants are for a developing country, the less it will be inclined to correctly manage its public finances to avoid unsustainable debt situations. In such instances, the grants will exert a positive effect on the total public debt.

The inflation rate

The impact of inflation on the public debt depends on how the latter is distributed among domestic and foreign creditors. In the case of developing countries and specifically in CFA Franc Zone countries, where usually a substantial part of the public debt is denominated in

foreign currency, the inflation impacts directly the domestic debt-to-GDP ratio and indirectly the ratio of external debt to GDP through the real effective exchange rate.

A rise in inflation erodes the real value of the domestic debt hold by creditors and the effective debt ratio, unless all domestic debt is indexed to prices or foreign currencies (though according to Panizza et al., (2011), in such cases inflation can debase indexed to prices if the government tinkers with the price index), a government can inflate away the domestic public debt by money creation, with the result of this inflating away of debt depending on the share of debt that is indexed to inflation. Although such policy measure can be implemented in ECCAS, it can't in WAEMU (see above). Panizza et al. (2011)[63] also point out the exceptional case where inflation can lead to a rise of public debt: in the case of a country facing a real appreciation (that is, where inflation outweighs the currency depreciation) and where a large share of domestic debt is indexed to inflation, the valuation effects will create a positive link between inflation and domestic currency debt.

6.2 Discussion on the choice of appropriate econometric technique

Since our dependent variable is binary (a dummy), we have to choose between two kinds of models: a linear probability model (LPM) and a non-LPM (logit or probit model). Whereas in LPMs, the probability of success and failure is considered to be a linear function of the covariates, in logit and probit models, the expected probability is an increasing non-linear function of the explanatory variables. However, compared with nonlinear models, there are several concerns regarding LPMs.

First, the marginal effect induced by a unit of variation of each covariate in an LPM is constant, whereas in nonlinear models it varies with each unit.

Second, in contrast to non-LPMs, the predicted probabilities of success or failure in an LPM may lie out of the interval [0,1]. On one side, Wooldridge (2002: 455) highlights that 'if the main purpose is to estimate the partial effect of the explanatory variables on the response probability, averaged across the distribution of these covariates, then the fact that some predicted values are outside the unit interval may not be very important. The linear probability model needs not provide very good estimates of partial effects at extreme values of the

[63] These authors recognize however that such situation is exceptional and argue it will likely be dominated by the case where inflation impacts negatively the domestic debt, in the absence of financial repression.

covariates'. In the same vein, Cameron and Trivedi (2005: 495) mention that ordinary least squares (OLS) estimations of such models provide a good guide to which variables are statistically significant. De Ree and Nillesen (2009: 306–307) also emphasise that 'the probit/logit and LPM often produce rather similar outcomes because the conditional distribution function tends to 'look' rather linear around its expected value, while at the same time, most draws from any conditional distribution are 'close' to the expected value'. On the other side, Horrace and Oaxaca (2006) point out that OLS estimates of LPMs, where the predicted probabilities are outside the unit interval, may lead to biased and inconsistent estimates. They propose the sequential least squares (SLS) procedure as a way of remedying this problem. These iterative procedure first trims from the data those OLS estimate observations with predictions lying outside the unit interval. Based on these estimations, the data are trimmed again and the model re-estimated. The procedure is repeated until no predictions are outside the unit interval and the SLS estimates are thus obtained.

Third, the problem of heteroskedasticity is likely to arise, leading to unbiased but inefficient coefficients (i.e., the standard errors are not valid for constructing confidence intervals and t-statistics). Weighted least squares are said to provide efficient estimates (Mullahy, 1990), but hold the disadvantage of having worse finite sample properties than OLS; further, the inferences based on asymptotic theory can be misleading (Altonji and Segal, 1996)[64]. To overcome this difficulty, we use OLS with heteroskedasticity-robust standard errors (i.e., White's correction of heteroskedasticity).

Despite the above-mentioned drawbacks, LPMs have the particular advantage of facilitating the interpretation of the coefficients of interaction variables, whereas such an interpretation is not straightforward in logit or probit models. Indeed, Ai and Norton (2003)[65] show that the marginal effect of an interaction term in nonlinear models, as provided by standard econometrics packages, may hold the wrong sign and significance and, consequently, cannot be interpreted as such. Greene (2010) challenges the way of interpreting Ai and Norton's (2003) results and notes that 'the process of statistical testing about partial effects, and interaction terms in particular, produces generally uninformative and sometimes contradictory

[64] See also Wooldridge (2002: 455), who discourages the use of weighted least squares in LPM when the predicted probabilities lies outside the range [0,1].

[65] According to these authors, the interaction effect is based on cross-partial derivatives with respect to the two interacted variables, which makes the sign and significance of the interaction term different for observations. They thus recommend relying on these derivatives and using the Delta method to assess the statistical significance of the marginal effect associated to the interaction term.

and misleading results. The mechanical reliance on statistical measures of significance obscures the economic, numerical content of the estimated model' (p. 295). He recommends performing the analysis not only through statistical procedures (see Greene, 2010 for details) but also by graphical presentations. He also emphasises the need to take into account the units of measurement when interpreting the partial effects of continuous variables, as the partial effect (per unit change) can be misleading.

Kolasinski and Siegel (2010) also criticise Ai and Norton's (2003) interpretation of the interaction term. They first contend that in Ai and Norton's (2003) results 'it is difficult to interpret the sign of interaction term coefficient because for some observations, the cross partial derivative of the probability of occurrence with respect to interacted covariates can have the sign opposite to that of the interaction term coefficient'. They argue that this is because of a mechanical saturation effect[66], which is irrelevant for researchers primarily concerned with proportional marginal effects. For such researchers, small changes in probability are more important near the boundaries than they are near the centre. Kolasinski and Siegel (2010) conclude that the interaction term coefficient (provided by nonlinear logit or probit regressions) remains a valid measure of interaction because it is already purged of the saturation effect. Consequently, they suggest researchers who are not concerned with the saturation effect, use it as such, while others (those for whom the mechanical saturation effect is important) use Ai and Norton's (2003) measure of interaction.

In the case of only one interaction effect, researchers may use the easy fixes provided by standard econometric packages (e.g., the use of 'inteff' ado-files in Stata) or the Delta method to obtain the interaction term in nonlinear models. However, these fixes become unusable in the case of double interaction effects ('inteff3' ado-files are available in Stata for the interaction of three dummies, but not for dummy(ies) and continuous variable(s)). Moreover, even using the Delta method to calculate standard errors, the computation becomes burdensome (as in our case here) with many interactions, especially with covariates[67] having high-order terms.

[66] Kolasinski and Siegel (2010) explain why saturation effects might not be economically relevant in certain contexts. They particularly show that, under general conditions, the saturation effect guarantees that the Ai and Norton measure of interaction will have the opposite sign from the interaction term coefficient, as one or more of the covariates take on extreme values.

[67] In our case, these interaction variables include the square of this covariate, the interaction of this square with a dummy variable and the interaction of this covariate with another explanatory continuous variable of the model.

For all these reasons and given the ongoing discussion on the best way of obtaining good interaction terms and interpreting them in nonlinear models, we rely in this study on nonlinear models to perform our analysis and only use LPMs for interpreting interaction terms. In other words, the nonlinear model estimations allow us to interpret solely the non-interacted variables, while the LPM estimation allows us to interpret the coefficients of the interaction variables.

However, we still have three concerns. The first concern relates to the choice of fixed or random effects to model unobserved heterogeneity, the second focuses on which nonlinear model (logit or probit) is suitable for our analysis and the third relates to the handling of temporal duration dependence.

-First, we use fixed effects, which capture heterogeneity among countries as well as the likely importance of unobservables correlated with the error term in determining the probability of excessive public debt, rather than random effects for two main reasons. First, since our sample is composed of heterogeneous countries, state-invariant and unmeasured factors (e.g., political, financial institutions, the degree of creditworthiness, etc.) are likely to be correlated with the error term in determining the evolution of the public debt-to-GDP ratio. Second, our macro panel contains the whole population of CFA Franc Zone countries (i.e., WAEMU and ECCAS countries) rather than a random sample from a much larger universe of countries where the use of random effects may be more suitable.

-Second, estimating standard dummy variables in a fixed-effects logit model[68] using the unconditional Maximum Likelihood method can pose the incidental parameters problem, which presents significant challenges for obtaining unbiased parameter estimations. According to Neyman and Scott (1948), who first raised the issue of incidental parameters, the inconsistency of incidental parameters (fixed effects) arises because the number of incidental parameters N increases without bounds while the amount of information about each parameter is fixed. Hence, estimating a nonlinear model (especially an unconditional fixed-effects logit model) in large but narrow panels (with T fixed and N, the number of groups, growing infinitely) using the maximum likelihood method leads to

[68] Note, however, that unconditional fixed-effects probit models are biased. In addition, the conditional fixed-effects model is not suitable in our case because only countries that display some heterogeneity in the outcome variable are taken into account in estimating the model. The requirement is binding in this setup given the small size of the cross-section dimension of our panel and the fact that for certain countries, the dependent variable takes either 1 or 0.

severe bias (inconsistency) in the fixed effects and in the coefficients of the other control variables. This bias in the parameters is of the order of 1/T for balanced panels (Greene, 2007) and thus disappears as T becomes large. However, it is unclear which exact order of T produces unbiased estimates. Katz (2001) judges the performances of unconditional and conditional maximum likelihood estimators in fixed-effects logit models based on finite-sample properties where N units have been observed for T time periods. He shows evidence through a series of Monte Carlo experiments that for the time periods $T \geq 16$, unconditional and conditional maximum likelihood lead to the same results. Further, Greene (2007, p. 621) illustrates in Monte Carlo simulations using a sample of N = 1000 with 200 replications that the bias of parameters is only about 6.9% when T = 20, but as large as 100% if T = 2. In this chapter, our nonlinear model is estimated by relying on the unconditional fixed-effects logit model and, given the above discussion, the incidental parameter is not a problem in our case, as the temporal dimension of our panel is T= 29 years.

-Third, a concern when dealing with binary time-series cross-section models is how to model the temporal dependence (Beck et al., 1998), since in such situations, ordinary logit or probit models may result in too many inferences (too high t-statistics). The empirical literature offers several approaches to deal with the temporal dependence issue in such models: temporal dummy variables for each episode or 'spell' or specific transformations of time (duration variable) as covariates in the model (for e.g., a 'linear' time variable). Beck et al. (1998) show evidence that panel logit data are identical to grouped duration data and suggest dealing with this problem by adding a series of dummy variables to the model. These dummies should capture the number of years since the previous occurrence of an 'event'. However, according to them, this solution has the drawback that it leads to an important loss of degrees of freedom (owing to the large number of dummy variables) and makes the hazard rate function likely to zig zag over time. Consequently, Beck et al. (1998) propose replacing the dummy variables with a smooth function based on 'natural cubic splines'. This vector of spline-based variables, which are cubic polynomials of the time (t), smooth out the coefficients and the hazard function based on them. Hence, the number of spline variables will be lower than the number of time dummies; further, the statistical significance will be easier to achieve and the time dependence of the hazard function straightforward to test (see also the application of this technique in the recent chapter by

Castro and Martins, 2012). In this chapter, we model the temporal dependence by using the 'natural cubic splines' as proposed by Beck et al. (1998). Moreover, we also follow another of Beck et al.'s (1998) suggestions by adding a variable that picks up the number of past events (e.g., the number of past episodes of non-excessive debt in our case). The inclusion of such a variable is justified by the fact that standard logit models assume 'excessive debt' states to be independent of one another, an argument which is obviously not true.

7. Empirical results

This section presents the results obtained from the statistical analysis (Table 1) and those obtained from the estimations of the different model specifications discussed above (Tables 2 to 5). Note that we standardise all our continuous covariates to allow meaningful economic interpretations.

Table 1: Fractional Polynomial Analysis

Model	Hypothesis to be tested	df	Deviance	G^2	P-Value
M0: The variable 'EVI' is not included in the model		0	131.56482		
M1: The variable 'EVI' is included in the model	M0 nested in M1	1	130.85196	0.712856	0.3985
M2: 'EVI' and its square are included in the model	M1 nested in M2	1	123.21382	7.638146	0.0057

Note: df = Degree of Freedom; G^2 = Likelihood Ratio associated to the difference of Deviances; P-Value = Probability associated to G^2.

Before presenting these results, we first highlight one shortcoming of this study. Although it is possible to estimate the different specifications of the model for the panel of WAEMU countries, such estimations are not possible for ECCAS sub-sample of countries either by the use of the logit model (the results do not converge) or by the use of the trimmed sample for the LPM (because in trimming the data, we are left with few observations, which prohibits statistical inferences). This shortcoming of the cross-sectional dimension of our panel prevents us from performing a graphical analysis of the interaction terms (as recommended by Greene, 2010). Further, this is especially the case when our variables of interest (EVI and its square/or EVI components and their squares) are interacted with the dummyWAEMU to measure how the partial effect of EVI – and its square/or EVI components and their squares – on the probability of excessive debt varies with a switch from WAEMU to ECCAS.

Table 1 (above) shows the results obtained from performing a fractional polynomial analysis (FPA) to find out the correct parametric form for our variable of interest (the 'EVI' predictor), namely to check the linearity of that variable with the logit model (e.g., Hosmer and Lemeshow, 1999, 2000). The FPA consists of choosing between competing models by performing an Analysis of Deviance[69] where the deviance statistics of these models are compared. The difference in the deviance between the two models is the likelihood ratio, G^2, which has a null Chi-Squared distribution (Agresti, 2002). The FPA's results suggest that the minimum deviance statistic (i.e., 123.21) is observed for model M2. In other words, model M2 is the best fitting nonlinear transformation that contains the 'EVI' and 'EVI square' variables. In fact, when comparing model M2 (the nonlinear model) with the linear model M1, we find evidence that the likelihood ratio test statistic, G^2 (i.e., the deviance for model M1 minus that for M2), is 7.638, with a significance level as follows: p-value $= \Pr(\chi^2(1) \geq 7.638) = 0.0057$. Since this p-value is lower than 0.01, we conclude that model M2 is significantly different from model M1 and therefore retains the nonlinear specification that contains the 'EVI' and 'EVI square' variables. The inclusion of EVI's components in the analysis (see Tables 3, 5 and 6) allows us to explore whether the effects of 'EVI' on the chance of CFA Franc Zone countries entering into excessive debt are driven mainly by the variables 'exposure' and/or 'shock'. Nevertheless, we recognise that the effects of shocks on the probability of the excessive debt of a given country pertaining to this Zone could depend on the exposure of this country to shocks. To take into account (at least partially) the interaction between 'exposure' and 'shock', we include in the specification the variable 'exposureshock', which is the result of multiplying the 'exposure' and 'shock' variables (see the details in Appendix 1).

Tables 2 to 5 have the same structures. We report in Columns [1], [2], [3] and [4] the results associated respectively to the unconditional fixed-effects logit model, the average partial effects regarding the latter, the results obtained from the LPM based on the whole sample and the results obtained from the LPM based on the trimmed sample (following the SLS procedure). Irrespective of the table considered (Tables 2 to 4), we find evidence that the results (sign, significance and magnitude of coefficients) of the LPM based on the whole sample are similar to the average partial effects of the unconditional logit specification,

[69] Note that the Analysis of Deviance is like the ANOVA used in multivariate normal regressions.

whereas the results of the LPM based on the SLS procedure are not[70]. In addition, the magnitudes of the coefficients of the two LPMs are unexplainable differences.

Table 2 presents the results of the model specification comprising both the variables 'EVI' and its square. Following Greene (2010), we performe a simple Wald test of the zero interaction effect[71] for the coefficient of 'EVI' and that of 'EVI square' (see the Appendix 4 for the derivations of the logit model to obtain the interaction term, especially when applied to the simple case of a model specification where we have both a continuous variable and its square). As this test is sufficient but not necessary (Greene, 2010), it provides us with a good insight into the statistical significance of the 'EVI square' coefficient.

The result of this test shows that the interaction term (the coefficient of 'EVI' square) is statistically significant ($\chi^2(2) = 7.76$ with a p-value = 0.0206). Despite the divergence of the results between the LPM based on the whole sample and that based on the SLS procedure (Columns [3] and [4]), we obtain evidence that EVI is associated with nonlinearity with respect to the likelihood of excessive debt in CFA Franc Zone countries. We can conclude that irrespective of the potential control variables, 'EVI' displays an inverted U-shaped curve relationship with the probability of entering into excessive debt in the CFA Franc Zone: an increase in one standard deviation of 'EVI' leads to a higher probability of excessive debt in this Zone; for higher levels of 'EVI', this probability decreases. The top point (turning point) of the 'standardised EVI' is approximately 0.50 for the LPM based on the whole sample and 0.4749 for the LPM based on the trimmed sample. As can be observed from these results, the turning points are almost the same. These results can be interpreted as follows: when the 'EVI' of these countries increases over time, they resort to domestic and/or external debt in order to cope with the rise in the "EVI" variable, thereby increasing their likelihood of indebtedness. However, after a certain level of 'EVI', it seems that these countries draw on their con-costly financial resources (see the details above) to cope the additional burden inflicted by the rise in structural vulnerability.

[70] However, the sign and significance of certain estimates in the LPM based on the SLS procedure are identical to those of the logit model.

[71] As mentioned above, according to Ai and Norton (2003), the interaction effect is based on cross-partial derivatives with respect to the two interacted variables, which makes the sign and significance of the interaction term different for these observations.

Table 2: EVI's Effect on the probability of Excessive Debt in CFA Franc Zone Countries

	Dependent Variable : Excessive Debt Dummy			
Explanatory Variables	**Logit Model (Fixed Effects)**	**Average marginal effect (partial**	**Linear Probability Model on the whole sample**	**Linear Probability Model on the trimmed sample[b]**
	(1)	**(2)**	**(3)**	**(4)**
Evi	17.80***	1.038***	1.149***	3.702***
	(6.444)	(0.355)	(0.370)	(1.231)
Evisq	-18.46***	-1.076***	-1.150***	-3.897***
	(6.890)	(0.3794)	(0.397)	(1.265)
$Fiscal\_balance_{t-1}$	1.024	0.056	0.0255	0.204
	(0.703)	(0.041)	(0.0340)	(0.157)
$Gdpgrowth_{t-1}$	-0.328	-0.02	-0.0360*	-0.0232
	(0.341)	(0.02)	(0.0214)	(0.0694)
$Inflation_{t-1}$	-0.770*	-0.045*	-0.0410	-0.135
	(0.416)	(0.024)	(0.0265)	(0.0938)
$Grantsgdp_{t-1}$	1.802***	0.105***	0.0573	0.796***
	(0.564)	(0.031)	(0.0385)	(0.276)
$REER_{t-1}$	-0.767*	-0.045*	-0.121***	-0.143
	(0.447)	(0.026)	(0.0308)	(0.0925)
Termstrade	-3.058***	-0.18***	-0.126***	-0.501***
	(0.742)	(0.039)	(0.0295)	(0.167)
Pacte	-3.229***	-0.188***	-0.143***	-0.444**
	(1.022)	(0.056)	(0.0479)	(0.203)
Number	-2.308***	-0.135***	-0.217***	-0.488***
	(0.557)	(0.028)	(0.0402)	(0.118)
Variable	-1.095***	-0.064***	-0.0657***	-0.139*
	(0.228)	(0.011)	(0.0123)	(0.0743)
Spline (1)	-0.00107	-0.00006	-0.000317**	0.000443
	(0.00119)	(0.00007)	(0.000147)	(0.00157)
Spline (2)	-0.000170	-9.91e-06	0.000234	0.0257**
	(0.00233)	(0.00014)	(0.000160)	(0.0113)
Spline (3)	-0.0122***	-0.00071***	-0.000282	-0.0192*
	(0.00423)	(0.00023)	(0.000336)	(0.0103)
Observations	317		344	99
Log likelihood	-61.606908			
Wald $Chi2^{c}$ / F-Statistic (P-Value)	64.44 (0.0000)		157.20 (0.0000)	8.63 (0.0000)
R Squared			0.838	0.7546
Joint F-test on « Duration dependence » variables	23.27 (0.0001)		8.40 (0.0000)	5.18 (0.0010)
Fixed Effects Significance	51.41 (0.0000)		141.24 (0.0000)	12.95 (0.0000)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis. a: The average marginal effects are computed using the Delta method. b: This is the Sequential Least Square procedure of Horrace and Oaxaca (2006). c: The Wald test and the P-Value associated concern the logit model where all coefficients are tested to be jointly equal to zero. The F-statistic and the P-value are associated to the linear probability models.

Hypothesis 2 thus seems to be valid here. Consequently, the same reasoning will be applied in cases where we observe a negative effect of 'EVI square' and a positive effect of 'EVI'.

In terms of the control variables, as shown by the Joint F-test on the duration dependence variables (Column [1]), there is a negative duration dependence in the behaviour of CFA

Franc Zone countries compared with their likelihood of entering into excessive debt. In addition, the 'Convergence, Stability, Growth and Solidarity Pact' has lowered the likelihood of these countries entering into excessive debt compared with the period where such budgetary discipline does not exist (1980–1998). The probability of excessive debt is also positively driven by a rise in the grants, a rise in inflation, a depreciation in the real exchange rate and a deterioration in terms of trade. Real GDP growth and the fiscal balance seem to exert no statistical effect on the probability of excessive debt in CFA Franc Zone countries.

Table 3 contains the results of the model specification where 'EVI' and its square are replaced by EVI's components as well as their squares. The average partial effects (Column [2]) of the control covariates are roughly the same as those of Table 1 (Column [2]), except that here, the fiscal balance variable is positively associated with the probability of excessive debt in CFA Franc Zone countries. In other words, an improvement in the fiscal balance leads these countries to enter into excessive debt.

Table 3: EVI's components Effect on the probability of Excessive Debt in CFA Franc Zone Countries

	Dependent Variable : Excessive Debt Dummy			
Explanatory Variables	**Logit Model (Fixed Effects)**	**Average marginal effect (partial effects)[a]**	**Linear Probability Model on the whole sample**	**Linear Probability Model on the trimmed sample[b] (SLS procedure)**
	(1)	**(2)**	**(3)**	**(4)**
Exposure	-9.258	-0.4834815	-0.357	-2.849
	(9.356)	(.486234)	(0.467)	(1.827)
Shock	12.79	0.6676987*	1.220***	1.881
	(7.775)	(0.396062)	(0.332)	(1.466)
Exposuresq	16.83*	0.878965*	0.837	3.900*
	(9.780)	(0.5013442)	(0.518)	(2.082)
Shocksq	-9.284***	-0.4848228***	-0.460***	-2.064***
	(3.060)	(0.147198)	(0.177)	(0.579)
Exposureshock	-4.495	-0.2347203	-1.005***	-0.0285
	(9.033)	(0.4702039)	(0.335)	(1.596)
$Fiscal\_balance_{t-1}$	1.977**	0.1032258***	0.0437	0.635***
	(0.873)	(0.0440164)	(0.0341)	(0.196)
$Gdpgrowth_{t-1}$	-0.297	-0.0154988	-0.0342	-0.0470
	(0.381)	(0.0197703)	(0.0212)	(0.0806)
$Inflation_{t-1}$	-0.896*	-0.0467909*	-0.0404	-0.174
	(0.480)	(0.0244584)	(0.0250)	(0.121)
$Grantsgdp_{t-1}$	1.913***	0.0998922***	0.0371	1.074***
	(0.619)	(0.0301187)	(0.0374)	(0.275)
$REER_{t-1}$	-0.893*	-0.0466562**	-0.131***	-0.132
	(0.463)	(0.0232502)	(0.0323)	(0.0828)
Termstrade	-3.205***	-0.1673953***	-0.122***	-0.461***
	(0.814)	(0.0377766)	(0.0297)	(0.154)
Pacte	-2.965***	-0.1548515	-0.162***	-0.477**
	(1.051)	(0.051094)	(0.0539)	(0.180)
Number	-3.180***	-0.1660735***	-0.227***	-0.847***
	(0.724)	(0.0310941)	(0.0409)	(0.147)
Variable	-1.263***	-0.0659435***	-0.0652***	-0.153**

	(0.261)	(0.0109898)	(0.0121)	(0.0754)
Spline (1)	-0.00161	-0.000084	-0.000336**	0.000845
	(0.00125)	(0.0000646)	(0.000151)	(0.00349)
Spline (2)	0.000521	0.0000272	0.000293*	0.0320***
	(0.00281)	(0.0001465)	(0.000165)	(0.0109)
Spline (3)	-0.0152***	-0.0007923***	-0.000345	-0.0245*
	(0.00489)	(0.0002358)	(0.000351)	(0.0130)
Observations	317		344	83
Log likelihood	-55.237813			
Wald Chi2[c] / F-Statistic (P-Value)	58.24 (0.0010)		146.62 (0.0000)	6.75 (0.0000)
R Squared			0.840	0.784
Joint F-test on « Duration dependence » variables	23.46 (0.0001)		8.63 (0.0000)	6.66 (0.0002)
Fixed Effects Significance	38.82 (0.0001)		127.51 (0.0000)	9.38 (0.0000)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis. a: The average marginal effects are computed using the Delta method. b: This is the Sequential Least Square procedure of Horrace and Oaxaca (2006). c: The Wald test and the P-Value associated concern the logit model where all coefficients are tested to be jointly equal to zero. The F-statistic and the P-value are associated to the linear probability models.

Concerning our variable of interest ('EVI's components and their squares), the results of the LPM based on the full sample are suggestive of a statistically significance (at the 1% level) of the variables 'shock', 'shock square' and 'exposure*shock'. The results of the LPM based on the SLS procedure suggest, however, that among our variables of interest, only 'shock square' and 'exposure square' are statistically significant, although at the 10% significance level for the latter. Overall, we conclude from Table 3's results that the nonlinearity observed for EVI with respect to the probability of excessive debt in CFA Franc Zone countries seems to be driven to a certain extent by both the 'exposure' and the 'shock' components of the 'EVI' variable.

Table 4 discriminates between the impact of EVI on the probability of excessive debt in WAEMU versus ECCAS. Once again, the average partial effects associated with the control explanatory variables and shown in Column [2] display roughly the same sign, magnitude and significance as those in Table 2. In addition, we observe as in Table 3 that an improvement in the fiscal balance increases the chance of CFA Franc Zone countries entering into excessive debt: a one standard deviation rise in the fiscal balance (i.e., 9.25%) increases the probability of excessive debt by 7.4% (although the statistical significance is only 10%). Moreover, irrespective of the model specification considered (logistic, linear probability based on the full sample or on the trimmed sample), WAEMU countries have a greater chance of entering into excessive debt than ECCAS countries. The result in Column [2] shows that

holding all other covariates fixed, WAEMU countries have a 51.52% higher probability of entering into excessive debt compared with their ECCAS counterparts. Despite this difference in terms of behaviour, the inverted U-shaped relationship previously observed for EVI with respect to the probability of excessive indebtedness seems to be the same in terms of magnitude for WAEMU and ECCAS.

Table 4: 'EVI's Effect on the probability of Excessive Debt in WAEMU versus ECCAS

	Dependent Variable : Excessive Debt Dummy			
Explanatory Variables	**Logit Model (Fixed Effects)**	**Average marginal effect (partial effects)[a]**	**Linear Probability Model on the whole sample**	**Linear Probability Model on the trimmed sample[b] (SLS procedure)**
	(1)	**(2)**	**(3)**	**(4)**
Evi	1.737	0.0985157	0.289	0.574
	(12.73)	(0.7219109)	(0.495)	(1.888)
Evisq	-1.007	-0.0571219	-0.255	-0.516
	(14.75)	(0.8364606)	(0.484)	(2.091)
dummyWAEMU	3.631***	0.2059909***	0.890***	2.753***
	(1.202)	(0.0622984)	(0.162)	(0.452)
Eviwaemu	22.56	1.279856	2.279***	3.971*
	(14.56)	(0.8120269)	(0.810)	(2.183)
Evisqwaemu	-24.28	-1.377162	-2.470***	-4.232*
	(16.88)	(0.9428261)	(0.858)	(2.437)
$Fiscal\_balance_{t-1}$	1.307*	0.0741478*	0.0649**	0.218
	(0.790)	(0.0441364)	(0.0327)	(0.196)
$Gdpgrowth_{t-1}$	-0.196	-0.0111365	-0.0386*	-0.0734
	(0.372)	(0.0210011)	(0.0215)	(0.0732)
$Inflation_{t-1}$	-0.718*	-0.0407349*	-0.0374	-0.0792
	(0.431)	(0.0240257)	(0.0266)	(0.0821)
$Grantsgdp_{t-1}$	1.735***	0.0984442***	0.0496	0.309*
	(0.575)	(0.030467)	(0.0377)	(0.162)
$REER_{t-1}$	-0.733	-0.0416072	-0.118***	-0.100
	(0.464)	(0.02585)	(0.0297)	(0.0980)
Termstrade	-3.089***	-.1752252***	-0.146***	-0.455***
	(0.781)	(0.0405236)	(0.0281)	(0.170)
Pacte	-3.137***	-.1779594***	-0.110**	-0.533**
	(1.040)	(0.0557497)	(0.0488)	(0.243)
Number	-2.448***	-0.1388575***	-0.259***	-0.411***
	(0.594)	(0.028832)	(0.0399)	(0.112)
Variable	-1.086***	-0.0615867***	-0.0652***	-0.190***
	(0.228)	(0.0105242)	(0.0120)	(0.0514)
Spline (1)	-0.00104	-0.0000593	-0.000336**	-1.29e-05
	(0.00124)	(0.0000703)	(0.000150)	(0.000204)
Spline (2)	-0.000590	-0.0000335	0.000182	-0.000298
	(0.00248)	(0.0001404)	(0.000165)	(0.00100)
Spline (3)	-0.0112***	-0.0006339***	-0.000164	-0.00221*
	(0.00432)	(0.0002327)	(0.000337)	(0.00128)
Observations	317		344	111
Log likelihood	-60.179742			
Wald $Chi2^{c}$ / F-Statistic (P-Value)	64.22 (0.0001)		157.14 (0.0000)	8.82 (0.0000)
R Squared			0.843	0.749
Joint F-test on « Duration dependence » variables	22.86 (0.0001)		8.50 (0.0000)	3.71 (0.0079)
Fixed Effects Significance	31.64 (0.0009)		132.71 (0.0000)	10.75 (0.0000)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis. a: The average marginal effects are computed using the Delta method. b: This

is the Sequential Least Square procedure of Horrace and Oaxaca (2006). c: The Wald test and the P-Value associated concern the logit model where all coefficients are tested to be jointly equal to zero. The F-statistic and the P-value are associated to the linear probability models.

In Table 5, we use the model specification for which the results are displayed in Table 4 but replace the 'EVI' variable and its square by its components and their squares in addition to the interaction between the components. The average partial effects obtained for the control covariates are roughly the same as those reported in Table 4, except for the variable 'dummyWAEMU', where the average partial effect is higher than that in Table 4, and for the real exchange rate variable, which is here negative and significantly related to the likelihood of excessive indebtedness of CFA Franc Zone countries. As stipulated above, we cannot interpret the interaction terms associated with our variables of interest based on the average partial effects reported in Column [2]. Evidence is shown from Column [3] of Table 5 that despite the previously observed absence of a difference between WAEMU and ECCAS countries in terms of the nonlinearity of EVI with respect to the probability of excessive debt, a simultaneous rise in both 'exposure to shocks' and 'shocks' seems to exert a higher impact in WAEMU than in ECCAS countries. Further, the coefficient of the variable 'shock square' interacted with the variable 'dummyWAEMU' is negative and significant. Since the other interaction variables with the 'dummyWAEMU' are not statistically significant at the 10% level, the interpretation of such results would be based on the combination of the two previous results. Hence, from the results of the LPM based on the full sample, we find that a one standard deviation increase in 'exposure' and a one standard deviation rise in 'shock' will lead to a probability of excessive debt = (-1.184+1.59) = 0.406 = 40.6% higher in WAEMU than in ECCAS countries.

Table 5: 'EVI's components Effect on the probability of Excessive Debt in WAEMU versus ECCAS

	Dependent Variable : Excessive Debt Dummy			
Explanatory Variables	**Logit Model (Fixed Effects)**	**Average marginal effect (partial effects)[a]**	**Linear Probability Model on the whole sample**	**Linear Probability Model on the trimmed sample[b] (SLS procedure)**
	(1)	**(2)**	**(3)**	**(4)**
Exposure	-17.26	-0.8111736	-1.656**	-4.004
	(18.12)	(0.8479976)	(0.671)	(2.887)
Shock	18.51	0.8698677	1.176***	5.433*
	(13.15)	(0.6040299)	(0.370)	(3.079)
dummyWAEMU	10.96***	0.5151719***	1.523***	2.349***
	(2.796)	(0.1117504)	(0.189)	(0.764)
Exposuresq	27.86	1.309631	1.944***	7.009**
	(17.70)	(0.8181585)	(0.641)	(3.240)
Shocksq	2.916	0.1370845	-0.0337	0.851

	(5.787)	(0.2716366)	(0.160)	(0.983)
Exposureshock	-27.43*	-1.28945*	-1.522***	-8.453**
	(15.27)	(0.6934194)	(0.341)	(3.767)
Exposurewaemu	-2.192	-0.1030191	0.964	0.825
	(22.34)	(1.050018)	(1.114)	(3.947)
Shockwaemu	-4.572	-0.2148894	0.0277	-3.176
	(15.96)	(0.7488446)	(0.690)	(3.933)
Exposuresqwaemu	1.554	0.0730482	-0.892	-1.754
	(23.00)	(1.080952)	(1.276)	(4.270)
Shocksqwaemu	-14.99**	-0.7046872**	-1.184***	-3.134**
	(6.886)	(0.3102294)	(0.301)	(1.320)
Exposureshockwaemu	27.45	1.290239	1.588*	8.937*
	(18.62)	(0.8557206)	(0.904)	(4.959)
$Fiscal\_balance_{t-1}$	2.094**	0.0984357**	0.0556*	0.527*
	(0.987)	(0.0450082)	(0.0320)	(0.287)
$Gdpgrowth_{t-1}$	-0.239	-0.0112262	-0.0436**	-0.0309
	(0.452)	(0.0211115)	(0.0178)	(0.137)
$Inflation_{t-1}$	-1.034**	-0.0486139**	-0.0407*	-0.201
	(0.519)	(0.0234128)	(0.0239)	(0.135)
$Grantsgdp_{t-1}$	1.951***	0.0917232***	0.0553	0.503**
	(0.633)	(0.0272569)	(0.0382)	(0.212)
$REER_{t-1}$	-1.464**	-0.0688191**	-0.119***	-0.325*
	(0.631)	(0.0284533)	(0.0284)	(0.179)
Termstrade	-3.165***	-0.1487908***	-0.169***	-0.661**
	(0.947)	(0.0411214)	(0.0293)	(0.306)
Pacte	-2.821**	-0.1326018***	-0.144***	-0.493*
	(1.121)	(0.0499856)	(0.0513)	(0.273)
Number	-3.316***	-0.1558461***	-0.302***	-0.713***
	(0.723)	(0.0260734)	(0.0412)	(0.178)
Variable	-1.334***	-0.0626965***	-0.0648***	-0.347***
	(0.291)	(0.0110908)	(0.0117)	(0.113)
Spline (1)	-0.00190	-0.0000892	-0.000279*	-0.000273
	(0.00153)	(0.000071)	(0.000144)	(0.000248)
Spline (2)	0.00242	0.0001136	0.000285*	0.00149**
	(0.00423)	(0.0001987)	(0.000163)	(0.000734)
Spline (3)	-0.0172***	-0.000807***	-0.000408	-0.00565***
	(0.00620)	(0.0002734)	(0.000334)	(0.00193)
Observations	317		344	80
Log likelihood	-49.682483			
Wald $Chi2^c$ / F-Statistic (P-Value)	53.34 (0.0185)		136.23 (0.0000)	5.07 (0.0001)
R Squared			0.860	0.737
Joint F-test on « Duration dependence » variables	21.34 (0.0003)		8.92 (0.0000)	3.30 (0.0183)
Fixed Effects Significance	23.72		45.32 (0.0000)	9.38 (0.0000)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis. a: The average marginal effects are computed using the Delta method. b: This is the Sequential Least Square procedure of Horrace and Oaxaca (2006). c: The Wald test and the P-Value associated concern the logit model where all coefficients are tested to be jointly equal to zero. The F-statistic and the P-value are associated to the linear probability models.

We highlighted above the first shortcoming of our study. Another shortcoming is the difficulties in using a political/institutional variable. In fact, we intend to see whether the quality of governance in these countries alleviates or even renders statistically nil the effect of 'EVI' (and its square) on the probability of excessive debt and whether once taking into account this variable, the effects of our variables of interest differ between WAEMU and ECCAS countries.

For this reason, we need to introduce the variable 'quality of governance' into the model. However, since the data on this variable are not available for many countries of our sample and given the small size of the latter, we cannot use either the logistic model or the LPM based on the trimmed sample to perform this analysis. Accordingly, to have an idea of such effect, we rely solely on the LPM based on the full sample (the data available are also not sufficient to apply the SLS procedure), the results of which are presented in Table 6.

Table 6: 'EVI's components Effect on the probability of Excessive Debt in WAEMU versus ECCAS: Taking in account institutional and political variables.

	Dependent Variable : Excessive Debt Dummy		
Explanatory Variables	**Linear Probability Model on the whole sample**	**Linear Probability Model on the whole sample**	**Linear Probability Model on the whole sample**
	Model with the variable "Quality of Governance"		**Model with the variable "civtot"**
	(1)	**(2)**	**(3)**
Evi	2.035**		0.166
	(0.888)		(1.642)
Evisq	-2.059*		0.0903
	(1.075)		(1.873)
Eviwaemu	-1.020		3.764**
	(1.169)		(1.834)
Evisqwaemu	1.194		-4.233**
	(1.382)		(2.101)
Exposure		0.0379	
		(1.032)	
Shock		1.367*	
		(0.707)	
dummyWAEMU	0.739***	1.728***	2.153***
	(0.133)	(0.274)	(0.429)
Exposuresq		0.965	
		(1.172)	
Shocksq		1.794**	
		(0.887)	
Exposureshock		-2.929***	
		(1.072)	
Exposurewaemu		-0.538	
		(1.39)	
Shockwaemu		-0.669	
		(0.853)	
Exposuresqwaemu		-0.392	
		(1.592)	
Shocksqwaemu		-2.968***	
		(0.999)	
Exposureshockwaemu		3.717***	
		(1.205)	
Qog	-0.143	-0.350	
	(0.243)	(0.284)	
Civtot			0.117*
			(0.0703)
$Fiscal\_balance_{t-1}$	-0.0238	-0.016	0.214
	(0.0417)	(0.037)	(0.143)
$Gdpgrowth_{t-1}$	-0.0234	-0.032	-0.0366
	(0.0300)	(0.028)	(0.0696)
$Inflation_{t-1}$	-0.005	-0.0017	-0.105
	(0.026)	(0.026)	(0.0792)

$Grantsgdp_{t-1}$	0.013	0.014	0.297*
	(0.028)	(0.025)	(0.152)
$REER_{t-1}$	-0.117***	-0.108**	-0.0991
	(0.039)	(0.045)	(0.0976)
Termstrade	-0.147***	-0.138***	-0.440***
	(0.035)	(0.035)	(0.135)
Pacte	-0.10*	-0.189***	-0.452**
	(0.06)	(0.066)	(0.220)
Number	-0.374***	-0.335***	-0.410***
	(0.053)	(0.057)	(0.112)
Variable	-0.102***	-0.102***	-0.198***
	(0.021)	(0.024)	(0.0477)
Spline (1)	-0.000519***	-0.00044**	-0.000135
	(0.000175)	(0.00021)	(0.000174)
Spline (2)	0.00025*	0.000268	-0.000165
	(0.00014)	(0.000164)	(0.000281)
Spline (3)	-0.00015	-0.0003	-0.00212***
	(0.00026)	(0.0003)	(0.000633)
Observations	218	218	116
F-statistic (Pvalue)	291.48 (0.0000)	246.25 (0.0000)	41.13 (0.0000)
R Squared	0.921	0.931	0.746
Joint F-test on « Duration dependence » variables	11.94 (0.0000)	14.53 (0.0000)	4.36 (0.0029)
Fixed Effects Significance	9.72 (0.0000)	12.79 (0.0000)	7.46 (0.0000)

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. All these models contain country-dummies fixed effects. Standard Errors are in parenthesis. a: The average marginal effects are computed using the Delta method. b: This is the Sequential Least Square procedure of Horrace and Oaxaca (2006). c: The Wald test and the P-Value associated concern the logit model where all coefficients are tested to be jointly equal to zero. The F-statistic and the P-value are associated to the linear probability models.

The idea underlying the introduction of an institutional variable in the analysis is that the better the quality of institutions, the lower the build-up of public debt and thus the lower the likelihood of entering into excessive indebtedness. In addition, there is a need for developing countries that are structurally vulnerable to set up adequate institutions to promote competitiveness, build economic resilience and promote sustainable development (Farrugia, 2007). Thus, institutions in developing countries, particularly in CFA Franc Zone countries, should be as strong as possible to reflect the governance aspects inside their economic environments.

By assuming that the variable 'quality of governance' really captures the quality of governance in these countries, the results in Table 6 show that although this variable appears with the expected sign, it is not statistically significant. Moreover, it does not affect the nonlinearity relationship between EVI and the probability of excessive debt in CFA Franc Zone countries. The magnitude associated with this nonlinear relationship is the same for WAEMU and ECCAS countries, even if the probability of excessive debt itself is higher in WAEMU countries than it is in ECCAS countries. The results obtained for the EVI's components and their squares, as well as their interactions with the 'dummyWAEMU' variable, are consistent with the estimates in Table 5. With regard to the other control

variables, the likelihood of CFA Franc Zone countries entering into excessive debt seems to be driven positively by a depreciation in the real exchange rate or deterioration in terms of trade. The 'Convergence, Stability, Growth and Solidarity Pact' has exerted a negative impact on this probability, while the duration dependence remains negative and significant. The remaining control variables do not seem to be statistically significant. We conclude that if the variable 'quality of governance' really captures the quality of governance in CFA Franc Zone countries, an improvement in such quality in these countries does not affect the relationship observed between EVI and the probability of these countries entering into excessive indebtedness.

As some of the CFA Franc Zone countries may be prone to conflict situation characterized by high societal violence (civil violence, ethnic violence, civil warfare and ethnic warfare), we find useful to include in our model specification a variable capturing such situation. We subsequently consider in our model specification the variable 'civtot' measuring the 'total summed magnitudes of all societal Major Episodes of Political Violence' (see the Appendix 1 for more details in this variable) and expect it to substantially increase the public debt to GDP ratio in these countries. Note that the latter is included in replacement of the variable 'quality of governance' because of data limitation, particularly regarding the variable 'Quality of Governance'. The results, based on the linear probability model using the Sequential Least Square procedure of Horrace and Oaxaca (2006), are displayed in column [3] of Table 6.

Apart from the variable 'grantsgdp' which is positive and significant (although at 10% level of significance), the introduction of the variable 'civtot' in the model doesn't change the significance and sign of the coefficients of the control (economic) variables compare to the case where we introduce the 'Quality of Governance' variable. However, in contrast with the case of the variable 'Quality of Governance', we note here that the introduction the variable 'civtot' in the model cancels out the significance of the variables 'Evi' and 'Evisq' – but the variables 'Eviwaemu' and 'Eviwaemusq' become significant. This peculiar result suggests that when we take into account the possible effect of political violence on the likelihood of excessive public indebtedness in CFA Franc zone countries, a difference appears between WAEMU and ECCAS in terms of the nonlinear effect of EVI on their probability of entering into public indebtedness. The coefficient of the variable 'civtot' is positive and significant (although at 10% level of significance), suggesting that higher all societal Major Episodes of

Political Violence in CFA Franc Zone countries induce higher probability of entering into excessive indebtedness.

8. Conclusion and policy implications

By using the 'debt rule' among other criteria implemented by both WAEMU and ECCAS countries within the CFA Franc Zone for macroeconomic stability and convergence purposes, this chapter assesses whether the structural vulnerability of such countries affects their indebtedness, and more particularly their likelihood of entering into excessive debt. To perform our analysis, we use the (structural) EVI jointly computed by Guillaumont et al. (2011) and the UN-DESA (United Nations –Department of Economic and Social Affairs) – indicator which is amongst others, used by the United Nations as one of the criteria for identification and graduation of Least Developed Countries (LDCs) -, and focus on a panel of 14 CFA Franc Zone countries over the period 1980–2008. We also replace in the model specifications the 'EVI' variable with its components. Overall, the results are suggestive of a nonlinear effect of 'EVI' with respect to the probability of entering into excessive debt: for a rise in EVI, the probability of excessive debt increases in CFA Franc Zone countries; however, for higher EVI, this probability significantly declines. Moreover, although the improvement of institutions quality in these countries which are mostly least-developed Countries (LDCs) is highly desirable for economic growth and development purposes, it does not appear to influence the effect of EVI on the public indebtedness of these countries.

Given the development challenges faced by CFA Franc Zone countries and the structural vulnerability of their economies, it is likely that repeated experiences of structural shocks will not facilitate the implementation of appropriate policy responses to these shocks. This is because further to one shock, the response capacity of these countries weakens, which subsequently increases their structural economic vulnerability. In such context, the international development institutions such as the World Bank and International Monetary Fund (IMF) should take into account such vulnerability in their assessment of the adequate development policies and recommendations - especially those related to debt issues -, to these countries.

Several international policy options, including a rise in international assistance (mainly in the form of grants) and private financing could be explored to directly address the structural vulnerability of these economies, while ensuring that such flows are managed in a way to

avoid any adverse macroeconomic implications, particularly substantial public debt. In the meantime, the international community should ensure that these countries reduce over the medium and long term their high dependence on international assistance as, sooner or later, aid flows will severely shrink, situation which is best illustrated by the current economic conditions of developed countries. The international community should also develop mechanisms that help these countries increase their capacity to design the appropriate policy responses to further shocks on their economies.

Appendix

Appendix 1: Definition and Source of variables

Variable and Definition	Source and Comments
Dummyexcessivedebt	The author 's computation is based on the IMF's database on Gross Public Debt – The IMF's database weblink on Gross Public debt is: http://www.imf.org/external/ns/cs.aspx?id=262. This dummy variable takes the value '1' if the total Gross Public Debt-to-GDP ratio is higher than 70% and the value'0', otherwise.
EVI = Economic Vulnerability Index	Guillaumont and Cariolle, J. (2011).
Exposure = Exposure Index	We use the 'exposure index' provided by Guillaumont and Cariolle, J. (2011) that we divide by 2, as the 'EVI' is the average of Exposure Index and Shock Index.
Shock = Shock Index	We use the 'exposure index' provided by Guillaumont and Cariolle, J. (2011) that we divide by 2, as the 'EVI' is the average of Exposure Index and Shock Index.
Fiscal_balance = Fiscal Balance in percentage of GDP	Centre d'Etudes et de Recherches sur le Developpement International (CERDI)'s Public Finance Database. Fiscal balance is the overall revenue (tax and non-tax revenue), excluding grants minus government expenditures.
Gdpgrowth = Real Gross Domestic Product (GDP) growth (annual %)	World Development Indicators (WDI) 2011
Termstrade = Net barter terms of trade index (2000 = 100)	World Development Indicators (WDI) 2011
REER = Real Effective Exchange Rate, Base 100 = 2000	CERDI's Database: This is the Real Effective Exchange Rate, base 2005 = 100 computed by CERDI: it is the ratio of prices in the country to prices in the main import partners adjusted for variations in nominal effective exchange rate. An increase means an appreciation.
Grantsgdp = Grants in percent of GDP.	Grants data are grants disbursements by all donors expressed in current millions of US Dollars. They are extracted from the OECD Statistical Database. The GDP used to calculate the ratio of Grants in percentage of GDP is extracted from the World Development Indicators (WDI) 2011.
Inflation = Inflation, GDP deflator (annual %)	World Development Indicators (WDI) 2011
DummyWAEMU	This an indicator variable taking the value '1' if the country of CFA Franc Zone is WAEMU's member, and '0', otherwise.
Number	This variable indicates the number of prior excessive debt episodes (or spells)
Pacte	This is a dummy variable capturing the entry into force of the 'Stability, Growth and Solidarity Pact' within the zone franc since 1999. It takes the value '1' for the years 1999-2008, and '0', otherwise.
Quality of Governance	The quality of governance is measured by subjective indices from the International Country Risk Guide (ICRG). The quality-of-governance index from ICRG used here is an 18-point scale, created by summing the following three six-point scales: corruption in government, bureaucratic quality, and the rule of law. See the ICRG for the criteria used in coding these measures. The rationale for corruption and bureaucratic quality is obvious. The rule-of-law definition indicates that this measure reflects the government's administrative capacity in enforcing the law, as well as the potential for rent-seeking associated with weak legal systems and insecure property rights. Source: International Country Risk Guide (ICRG) Data.

Civtot	Civtot is the Total summed magnitudes of all societal Major Episodes of Political Violence (MEPV). CIVTOT (2-numeric) = CIVVIOL + CIVWAR + ETHVIOL + ETHWAR CIVVIOL (2-numeric) = the Magnitude score of episode(s) of civil violence involving that state in that year; Scale: 1 (lowest) to 10 (highest) for each MEPV. Magnitude scores for multiple MEPV are summed; 0 denotes no episodes. CIVWAR (2-numeric) = Magnitude score of episode(s) of civil warfare involving that state in that year Scale: 1 (lowest) to 10 (highest) for each MEPV; Magnitude scores for multiple MEPV are summed; 0 denotes no episodes. ETHVIOL (2-numeric) = Magnitude score of episode(s) of ethnic violence involving that state in a given year. Scale: 1 (lowest) to 10 (highest) for each MEPV; Magnitude scores for multiple MEPV are summed; 0 denotes no episodes. ETHWAR (2-numeric) = Magnitude score of episode(s) of ethnic warfare involving that state in that year Scale: 1 (lowest) to 10 (highest) for each MEPV; Magnitude scores for multiple MEPV are summed; 0 denotes no episodes.
Other Variables Evisq = The square of 'EVI'; Exposuresq = the square of 'Exposure'; Shocksq = the square of 'shock'; Exposureshock = Exposure*Shock; Eviwaemu = Evi*DummyWAEMU; Evisqwaemu = Evisq*DummyWAEMU; Exposuresqwaemu = Exposuresq*DummyWAEMU; Shocksqwaemu = Shocksq*DummyWAEMU; Exposureshockwaemu = Exposureshock*DummyWAEMU.	

Appendix 2: Statistics on Periods of 'Excessive debt' on CFA Franc Zone countries

Country	Period of the data on Total Public Debt availability	Period of 'Excessive debt'
Benin	1980-2008	1983; 1985; 1989-1991; 1993-1995
Burkina Faso	1980-2008	'No identified period of 'excessive debt'
Cameroon	1980-2008	1994-2003
Central African Rep.	1980-2008	1994-2008
Chad	1980-2008	1994; 1999-2000
Congo, Republic of	1980-2008	1981-2007
Côte d'Ivoire	1980-2008	1982-2008
Equatorial Guinea	1985-2008	1985-1996
Gabon	1980-2008	1987-1989; 1994-2003
Guinea-Bissau	1986-2008	1986-2008
Mali	1980-2008	1982-2001
Niger	1980-2008	1994-2002
Senegal	1980-2008	1983-1988; 1994-1999; 2001
Togo	1980-2008	1980-1989; 1991; 1993-2007

Appendix 3: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dummyexcessivedebt	393	0.524173	0.5000519	0	1
Evi	401	43.22752	9.917783	24.67814	72.40889
Exposure	406	26.19997	5.148306	16.6997	40.30086
Shock	401	17.0898	6.899618	5.937748	37.36527
Fiscal_balance	375	4.34111	9.248568	-17.94905	38.85204
Gdpgrowth	400	3.705248	7.968115	-28.09998	71.18799
Inflation	400	7.950738	15.72924	-29.17266	112.8948
Grantsgdp	401	9.980065	9.037769	0.193719	49.40295
REER	406	126.1705	34.87212	40.2845	259.0221
Termstrade	401	123.2465	55.78856	21.27743	357.5757
Pacte	406	0.2413793	0.4284478	0	1
Qog	245	0.3803713	0.1215567	0.1666667	0.6944445

Appendix 4: Interaction Effects

We provide here a general derivation of interaction effects in both linear and non-linear models, following Ai and Norton (2003) and Ai, Norton and Wang (2004). In fact, these authors demonstrate on the basis of a model comprising two interacted variables that the interaction effect is based on cross-partial derivatives with respect to the two interacted variables, which makes the sign and significance of the interaction term different for observations.

This Appendix is structured as follows:

- Firstly, we present a general derivation of interaction effects in linear models.
- Secondly, we focus on non-linear models, specifically logit model, where we consider interaction effects only for variables that do not have high order terms (that is for example, a continuous variable and its square): the demonstration is performed for two different cases: the first one deals with two interacted continuous variables and the second deals with two interacted variables where one is continuous and the other is a dummy.
- Thirdly, and lastly, we consider the case of non-linear (logit) model which contains continuous variables with high order terms.

1- Interaction effects in linear models

Consider the following linear specification of the expected value of dependent variable:

$E[y/x_1, x_2, x] = \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2 + x^T \beta$ **(1)**

where β_1, β_2 and β_{12} are parameters and β is a vector of parameters, all of them are unknown. x^T is a vector of variables that excludes x_1 and x_2 (that is, x^T is supposed to be independent of x_1 and x_2).

Assuming that x_1 and x_2 are continuous variables. The marginal effects of x_1 on the expected value $E = E[y/x_1, x_2, x]$ depends on x_2 if $\beta_{12} \neq 0$: $\frac{\partial E}{\partial x_1} = \beta_1 + \beta_{12} x_2$ **(2)**

The interaction effect given by the impact of a marginal change in x_2 on the marginal effect of x_1, is thus obtained from taking the derivative of (2) with respect to x_2: $\frac{\partial^2 E}{\partial x_2 \partial x_1} = \beta_{12}$ **(3).**

As a consequence, in linear specifications, the interaction effect $\frac{\partial^2 E}{\partial x_2 \partial x_1}$ equals the marginal effect $\frac{\partial E}{\partial (x_2 x_1)} = \frac{\partial E}{\partial w} = \beta_{12}$ where w represents the interaction term. However, in non-linear models such as logit and probit, this inequality does not hold. In the next section, we provide a general derivation of interaction effects in logit model where the interaction variables are continuous and where ther is no high order terms in the model.

2- Interaction effects in non-linear models: the case of logit model without high order terms

Consider now the following expected value of dependent variable y:

$$E[y / x_1, x_2, x] = F(\beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2 + x^T \beta) = F(u) \qquad \textbf{(4)}$$

Where F(u) is a nonlinear function of its argument $u = \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2 + x^T \beta$.

For example, in the logit model, F(u) is equals the cumulative distribution function defined as $F(u) = \frac{\exp(u)}{1 + \exp(u)}$ where exp denotes the exponentiel function. For probit model, F(u) would be the cumulative normal distribution function $\phi(u)$. Since in this chapter, we have used the logit model to perform our analysis, we will focus on this function for the derivation of the formulae of interaction effects if

(i) x_1 and x_2 are both continuous variables ;

(ii) x_1 is a continuous variable and x_2 is dummy variable.

(i) If F(u) is a twice differentiable function, with the first and second derivatives denoted by $F'(u)$ and $F''(u)$ being respectively the marginal effect with respect to x_1, we obtain the interaction effects formulae as following :

$$\frac{\partial^2 E}{\partial x_2 \partial x_1} = \frac{\partial}{\partial x_2}\left(\frac{\partial E}{\partial x_1}\right) = \frac{\partial}{\partial x_2}\left(\frac{\partial F(u)}{\partial x_1}\right) = \frac{\partial}{\partial x_2}\left[F'(u)\frac{\partial u}{\partial x_1}\right] = \frac{\partial}{\partial x_2}\left[f(u)\frac{\partial u}{\partial x_1}\right] \qquad \textbf{(5)}$$

The transformation of (5) leads to:

$$\frac{\partial}{\partial x_2}[f(u).(\beta_1+\beta_{12}x_2)] = f(u).\beta_{12}+(\beta_1+\beta_{12}x_2)(\beta_2+\beta_{12}x_1)f'(u) \quad \textbf{(6)}$$

For logit model where $F(u)=\frac{\exp(u)}{1+\exp(u)}$, evidence is shown that $F'(u)=[F(u)][1-F(u)]$ and $F''(u)=[F'(u)][1-2F(u)]=[F(u)][1-F(u)][1-2F(u)]$.

As a result,

$$\frac{\partial^2 E}{\partial x_2 \partial x_1} = \beta_{12}.[F(u)][1-F(u)]+(\beta_1+\beta_{12}x_2)(\beta_2+\beta_{12}x_1)[F(u)][1-F(u)][1-2F(u)] \quad \textbf{(7)}$$

This suggests that the interaction effect $\frac{\partial^2 E}{\partial x_2 \partial x_1}$ generally differs from the marginal effect $\frac{\partial^2 E}{\partial (x_2 x_1)}$ of the interaction term $w = x_2 x_1$.

(ii) Assume now that x_1 is a continuous variable and x_2 is dummy variable.

Consider the expected value function **(4)** where x_1 is a continuous variable and x_2 is dummy variable.

The mixed interaction effect $\frac{\Delta}{\Delta x_2}(\frac{\partial E}{\partial x_1})$ can be computed as follows:

$$\frac{\Delta}{\Delta x_2}(\frac{\partial E}{\partial x_1}) = \frac{\Delta}{\Delta x_2}(\frac{\partial F(u)}{\partial x_1}) = \frac{\partial F(u)}{\partial x_1}\Big|x_2 = 1 - \frac{\partial F(u)}{\partial x_1}\Big|x_2 = 0 \quad \textbf{(8)}$$

The transformation of (8) leads to the following expression:

$$\frac{\Delta}{\Delta x_2}(\frac{\partial E}{\partial x_1}) = F'(\beta_1 x_1 + \beta_2 + \beta_{12}x_1 + x^T\beta) - \beta_1 F'(\beta_1 x_1 + x^T\beta) \quad \textbf{(9)}$$

Note however that $\frac{\Delta}{\Delta x_2}(\frac{\partial E}{\partial x_1}) \neq \frac{\Delta}{\Delta x_1}(\frac{\partial E}{\partial x_2})$.

3- Interaction effects in non-linear models: the case of logit model with one high order terms (order 2)

(i) Consider the case of logit model with one high order terms (order 2) – this the case for our model with the variable 'EVI' and 'EVIsquare'

Instead of expectation (4), we now depart from the following expected value:

$$E[y/x_1, x_2, x] = F(\alpha_1 x_1 + \beta_1 x_1^2 + x^T \beta) = F(u) \qquad \textbf{(10)}$$

where $u = \alpha_1 x_1 + \beta_1 x_1^2 + x^T \beta$.

The formula of the interaction effect is:

$$\frac{\partial^2 E}{\partial x_1 \partial x_1} = \frac{\partial}{\partial x_1}(\frac{\partial E}{\partial x_1}) = \frac{\partial}{\partial x_1}(\frac{\partial F(u)}{\partial x_1}) = \frac{\partial}{\partial x_1}[F'(u)\frac{\partial u}{\partial x_1}] = \frac{\partial}{\partial x_1}[(\alpha_1 + 2\beta_1 x_1).F'(u)]$$

Hence, $\frac{\partial^2 E}{\partial x_1 \partial x_1} = 2\beta_1 F'(u) + (\alpha_1 + 2\beta_1 x_1).[F''(u)].\frac{\partial u}{\partial x_1}$ and finally,

$$\frac{\partial^2 E}{\partial x_1 \partial x_1} = 2\beta_1[F(u)][1-F(u)] + (\alpha_1 + 2\beta_1 x_1)^2[F(u)][1-F(u)][1-2F(u)] \qquad \textbf{(11)}$$

(ii) *Consider the case of logit model with two high order terms (order 2) – this the case for our model which contains the components of the variable 'EVI' and their squares.*

Instead of expectation **(10)**, we now depart from the following expected value:

$$E[y/x_1, x_2, x] = F(\alpha_1 x_1 + \alpha_2 x_2 + \beta_1 x_1^2 + \beta_2 x_2^2 + \beta_{12} x_1 x_2 + x^T \beta) = F(u) \qquad \textbf{(12)}$$

where $u = \alpha_1 x_1 + \alpha_2 x_2 + \beta_1 x_1^2 + \beta_2 x_2^2 + \beta_{12} x_1 x_2 + x^T \beta$.

The interaction term of the variable x_1^2 is obtained through the following expression:

$$\frac{\partial^2 E}{\partial x_1 \partial x_1} = \frac{\partial}{\partial x_1}[F'(u)\frac{\partial u}{\partial x_1}] = \frac{\partial}{\partial x_1}[(\alpha_1 + 2\beta_1 x_1 + \beta_{12} x_2).F'(u)] = 2\beta_1.F'(u) + (\alpha_1 + 2\beta_1 x_1 + \beta_{12} x_2)^2 F''(u)$$

Therefore, $\frac{\partial^2 E}{\partial x_1 \partial x_1} = 2\beta_1.[F(u)][1-F(u)] + (\alpha_1 + 2\beta_1 x_1 + \beta_{12} x_2)^2[F(u)][1-F(u)][1-2F(u)]$ **(13)**

Similarly, the interaction term of the variable x_2^2 is given by:

$$\frac{\partial^2 E}{\partial x_2 \partial x_2} = 2\beta_2.[F(u)][1-F(u)] + (\alpha_2 + 2\beta_2 x_2 + \beta_{12} x_1)^2 [F(u)][1-F(u)][1-2F(u)] \quad \textbf{(14).}$$

Overall, we conclude that for linear functions where $F(u) = u$ and where $F^{'}(u) = 1$, the interaction effect is given by β_{12}, for the nonlinear function such as logit, it is always different from β_{12}, even if the model contains variables with high order terms.

GENERAL CONCLUSION

Financing development is a major issue for developing countries, and particularly the poorest ones, which are exposed to external and internal shocks.

This thesis investigates two subjects: 'the relationship between ODA, migrants' remittances and fiscal episodes' and 'the structural economic vulnerability effect on public indebtedness of developing countries'. Each of these issues has been respectively decomposed in the following two questions, the subjects of the chapters of this thesis:

1) 'How do fiscal episodes in developed countries affect their aid supply?' and 'How do development aid unpredictability and migrants' remittances influence the fiscal consolidation decision of developing countries?'

2) 'What is the effect of the structural economic vulnerability of developing countries on the public debt of these countries?' and 'How does the structural economic vulnerability in CFA Franc CFA zone countries affect their excessive public debt?'

To answer these questions, we make use of both economic literature and econometric tools.

Main Results

The evaluation of the consequences of fiscal episodes in main OECD Donors on their aid supply leads to the following results:

- First, on the full sample of OECD DAC countries, we observe that fiscal consolidation episodes reduce aid effort, whatever aid variable considered, with these negative effects sometimes diminishing over time. However, fiscal stimuli episodes exert significant and positive effects only on aid the Net Aid Transfers variable of Roodman (2008, 2012), the other aid variables do not significantly respond to fiscal stimuli periods.
- Second, European Union countries exhibit the same behaviour in terms of aid effort as those of the full sample of countries. In contrast, aid exports of Non-European Countries (Non EU) do not seem to be affected during episodes of large fiscal retrenchment, whereas these countries reduce severely their aid supply during large episodes of loose discretionary fiscal policy with no decreasing of this negative effect over time.

Turning to the consequences of migrants' remittances and development aid unpredictability on fiscal consolidation measures in developing countries, the analysis distinguishes between two types of measures: gradual fiscal adjustment and rapid fiscal adjustment. The results obtained suggest that:

- Workers' remittances increase the likelihood of fiscal consolidation, be the latter gradual or rapid. This result remains valid for the two different sub-samples analysed in this chapter, except for low-income countries, for which we observe no effect of remittances on the decision to consolidate the budget gradually. This positive effect of remittances (irrespective of the sample considered) seems to have sometimes translated through fiscal policy variables.
- The unpredictability of aid inflows does not affect the adoption of fiscal consolidation measures in developing countries. The explanation can be rooted in either the utilization of such aid by the recipient countries that makes unaffected the government's budget, or because we control for the quality of governance variable.

The assessment of the impact of structural economic vulnerability in developing countries on their overall public debt also generates interesting results:

- With regard to the full sample of developing countries, as well as the sub-samples of LMICs and UMICs, EVI affects positively the build-up of public debt, but this positive effect appears after a threshold of the EVI. In other words, we observe the existence of a non-linear relationship (in the form of a U curve) between the EVI and public indebtedness in developing countries. The same findings apply when we use EVI's components rather than EVI itself. This result of EVI is confirmed when the analysis is performed over decades.
- By contrast, for LICs, the U curve relationship between EVI and the total public debt is observed only over decades.
- These results show the extent to which structural vulnerability in developing countries affects their public debt, especially in LICs.

We further focus on CFA Franc zone countries, and examine the way their structural vulnerability influence their likelihood of entry into excessive public debt. To do so, we rely on the debt rule adopted by these countries: the ratio of the total public debt to GDP should not exceed 70%. Overall, the results are suggestive of a nonlinear effect of 'EVI' with respect

to the probability of entering into excessive debt: a rise in EVI, the probability of excessive debt increases in CFA Franc Zone countries; however, for higher EVI, this probability significantly declines. Moreover, this result does not depend on the institutions quality of these countries - which are mostly least-developed Countries – which are supposed to mitigate their structural vulnerability.

Policy Implications of these Results

Several policy implications emerge from the results obtained regarding the effects of fiscal episodes in OECD Countries on their aid supply:

- We could infer that the fiscal adjustment measures being currently adopted by many developed countries, especially the European Union ones will negatively affect their aid expenditures, with these negative effects being likely higher than expected, given the severity of the crises. The recent OECD statistics in terms of ODA supply confirm these results especially with respect to the current public finances crises faced by Developed Countries. These curtailments will affect severely the investment spending of developing countries, especially Africans, with deleterious effects on economic growth and poverty reduction. As a result, the attainment of the Millennium Development Goals (MDGs) is likely to be severely jeopardized in these countries.
- Despite the current crucial role of aid inflows for many aid recipients (especially Low-Income Countries), these countries should reduce their aid dependency in the long term. In this respect, the International Community for example has a key role to play, including in helping these countries strengthen their mobilization of tax revenue by removing the main obstacles to the improvement of such mobilization. Emphasis should also be put on innovative financing mechanisms (as decided during the Monterrey Summit in 2002) through for instance the international financial tax transactions and the reduction of remittances costs at the international level. In addition, the deepening of domestic financial markets in these countries should be very helpful in allowing them to simultaneously rely less on foreign capital flows (whose borrowing could be very costly compared to domestic financing) and channel the saving towards investments for sustainable development purposes.

What about the relationship observed between transfers (that is, migrants' remittances and aid flows) and the likelihood of fiscal consolidation in developing countries?

Despite the well-known positive macroeconomic effects of remittances, the rise of the latter appears to lead governments' recipients in developing countries to adopt fiscal profligacy measures and to consolidate their budgets further. Better management of the revenues derived from these private transfers during their booms could help avoid such situations and allow greater room for manoeuvre for governments' recipients to implement countercyclical measures during bad times. Furthermore, the fact that the unpredictability of ODA flows does not appear to exert an impact on this probability does not rule out the possible of effect of unexpected aid shortfalls or rises on other macroeconomic variables (for e.g., on inflation and real exchange rate) and consequently of threatening the macroeconomic stability of the recipient country. As a result, a predictability of aid flows is strongly desirable.

Let us now turn to the relationship between structural economic vulnerability and public indebtedness in developing countries. The results suggest that, as for economic growth and other macroeconomic indicators, structural vulnerability also matters seriously for indebtedness in developing countries, particularly in LICs. We also obtain that this structural economic vulnerability affects the likelihood of CFA Franc Zone countries to engage in excessive public indebtedness. Hence, given the development challenges faced by developing countries and particularly LICs/CFA Franc Zone countries, it is likely that repeated experiences of structural shocks will not facilitate the implementation of appropriate policy responses to these shocks. This is because further to one shock, the response capacity of these countries weakens, which subsequently increases their structural economic vulnerability. In such context, the international development institutions such as the World Bank and International Monetary Fund (IMF) should take into account such vulnerability in their assessment of the adequate development policies and recommendations - especially those related to debt issues -, to these countries.

Several international policy options, including a rise in international assistance (mainly in the form of grants) and private financing could be explored to directly address the structural vulnerability of these economies, while ensuring that such flows are managed in a way to avoid any adverse macroeconomic implications, particularly substantial public debt. In the meantime, the international community should ensure that these countries reduce over the medium and long term their high dependence on international assistance as, sooner or later, aid flows will severely shrink, situation which is best illustrated by the current economic conditions of developed countries. The international community should also develop

mechanisms that help these countries increase their capacity to design the appropriate policy responses to further shocks on their economies.

CONCLUSION GENERALE

L'examen des conséquences des épisodes budgétaires dans les principaux pays donateurs de l'OCDE sur l'offre d'APD (Chapitre I) nous conduit aux conclusions suivantes :

- Premièrement, sur l'échantillon total des pays principaux donateurs de l'OCDE, les épisodes de consolidation budgétaire réduisent l'aide aux PED bénéficiaires, cette baisse diminuant cependant avec le temps. Cependant, les effets des épisodes d'expansion budgétaire dépendent du type de variable d'aide considéré avec un effet positif observé sur la variable « Aide Nette » de Roodman (2008, 2012) et un effet statistiquement nul obtenu pour les autres variables d'aide.
- Deuxièmement, les pays de l'Union Européenne (UE) affichent le même comportement en matière d'offre d'aide que ceux de l'échantillon total. En revanche, le sous-échantillon des pays n'appartenant pas à l'UE se comporte différemment avec une absence d'effet des sévères épisodes d'austérité budgétaire sur leur offre d'APD et un effet négatif sur l'APD des périodes d'expansion budgétaire.

L'analyse des conséquences des transferts des migrants et de l'imprévisibilité de l'APD sur les choix de consolidation budgétaire a été conduite en distinguant deux types de mesures d'austérité budgétaire : les mesures d'austérité budgétaire rapide et les mesures budgétaires d'austérité graduelles. Les résultats se présentent comme suit :

- Les transferts des migrants accroissent la probabilité de consolidation budgétaire (graduelle ou rapide). Ce résultat demeure valide lorsqu'on considère les sous-échantillons des économies fortement dépendantes des transferts des migrants et des PFR, à l'exception que pour ces derniers, il n'y a pas d'effet des transferts des migrants sur la décision d'adopter des mesures de consolidation graduelles. Cet effet obtenu des transferts des migrants semble parfois transiter par les recettes et/ou les dépenses de l'Etat.
- L'imprévisibilité les flux d'APD n'affecte pas la propension des gouvernements des PED à adopter des mesures d'austérité budgétaire. Les résultats demeurent vrais lorsqu'on focalise sur les deux sous-échantillons précités. Une utilisation usage de cette aide qui n'affecte pas directement le budget pourrait expliquer de tels résultats. De même, ces résultats pourraient tenir au fait qu'une meilleure gouvernance

annihilerait l'effet statistiquement significatif de l'imprévisibilité de l'APD sur la probabilité d'adopter des mesures d'austérité budgétaire dans les PED.

L'examen des effets de la vulnérabilité structurelle des PED sur leur endettement met en évidence des résultats tout aussi intéressants :

- On observe une relation non-linéaire en forme de « U » entre la vulnérabilité structurelle (ou ses composantes) et la dette publique des PED. Cette relation demeure valide lorsque l'on s'intéresse à l'échantillon des PRII et PRIS et suggère que l'effet positif de la vulnérabilité sur l'endettement n'apparaît qu'au-delà d'un seuil de vulnérabilité des PED. Les résultats demeurent aussi valides lorsque l'analyse est réalisée sur des périodes décennales.

- En revanche, pour les PFR, cette relation en forme de « U » n'est observée que sur des périodes décennales.

- Ces résultats montrent combien la vulnérabilité structurelle est déterminante dans l'endettement public des PED et en l'occurrence celui des PFR.

En focalisant sur les pays de la Zone Franc CFA, nous nous intéressons à la façon dont leur vulnérabilité structurelle les contraint à adopter des mesures d'endettement excessif. Cette étude est donc réalisée en nous appuyant sur la règle d'endettement adoptée par les pays de cette zone : le ratio de la dette publique totale (dette domestique et dette extérieure) du pays à son PIB ne devra pas excéder 70%.

Les résultats des analyses suggèrent un effet non-linéaire de la vulnérabilité structurelle sur la probabilité d'endettement excessif des pays de la zone Franc CFA. En effet, on observe que plus ces pays sont vulnérables, plus leur probabilité d'endettement excessif s'accroit, mais pour des niveaux de vulnérabilité très élevés, cette probabilité décline significativement. De même, ce résultat reste indépendant d'une amélioration de la qualité des institutions de ces pays (qui sont d'ailleurs pour la plupart des PMA) qui est sensée atténuer leur vulnérabilité structurelle.

Implications en termes de politiques économiques

Plusieurs implications en termes de politique économique émergent de ces résultats relatifs aux effets des épisodes budgétaires dans les pays de l'OCDE sur leur offre d'aide :

- Nous pouvons déduire des résultats obtenus que les mesures d'ajustement budgétaire actuellement en cours dans plusieurs pays développés donateurs, spécialement l'Union européenne auront des répercussions négatives sur l'APD, répercussions qui pourraient être bien plus fortes que nous l'espérions. Les statistiques récentes de l'OCDE en matière d'offre d'APD par les principaux donateurs semblent confirmer les résultats obtenus et ce, au regard de la crise que traversent actuellement les finances publiques des pays développés**.** Ces coupes dans l'APD affecteraient sensiblement les dépenses d'investissement des PED, notamment en Afrique avec des effets notoirement négatifs et significatifs sur la croissance économique et la réduction de la pauvreté. En conséquence, l'atteinte des Objectifs du Millénaire pour le Développement (OMD) sera compromise dans ces pays.
- En dépit du rôle crucial que jouent aujourd'hui les flux d'APD dans les pays récipiendaires (plus particulièrement les PFR), ces derniers devront réduire leur dépendance à l'aide à long terme. Á cet égard, la Communauté Internationale a un rôle important à y jouer, notamment en aidant ces pays à une meilleure mobilisation des recettes fiscales. Un accent important devra être aussi mis sur les mécanismes de financement innovants (tels que décidés lors du Sommet de Monterrey en 2002) à travers par exemple la taxe sur les transactions financières internationales et la réduction des coûts des transferts des migrants au niveau international. Par ailleurs, l'approfondissement des marchés financiers domestiques dans ces pays pourrait les aider à moins dépendre des flux de capitaux étrangers (dont l'emprunt pourrait coûter plus cher que le financement domestique) et orienter leur épargne vers des investissements qui contribueraient à un développement durable.

Qu'en est-il de la relation entre les transferts (les transferts des migrants et l'APD) et la probabilité de consolidation budgétaire dans les PED?

En dépit des effets macro-économiques positifs bien connus des transferts des migrants, une hausse de ces transferts conduit les gouvernements récipiendaires des PED à adopter des mesures budgétaires laxistes qui vont conduire par la suite à une consolidation de leurs finances publiques. Une meilleure gestion des recettes issues de ces transferts durant les

périodes de boom économique pourrait aider à éviter de telles situations et offrir une marge de manœuvre plus importante à ces gouvernements pour la mise en œuvre de politiques contra-cycliques pendant les périodes de basse conjoncture. En outre, l'absence d'effet de l'imprévisibilité de l'APD sur cette probabilité de consolidation budgétaire des PED n'enlève en rien la possibilité pour cette imprévisibilité de l'APD d'influer sur les autres variables macro-économiques (telles que l'inflation, et le taux de change réel). En conséquence, une forte prévisibilité de l'APD est souhaitable.

Considérons à présent la relation entre la vulnérabilité économique structurelle et l'endettement public des pays en développement. Les résultats suggèrent que, autant que la croissance économique et d'autres indicateurs macro-économiques, cette vulnérabilité influe sérieusement sur l'endettement des PED et en l'occurrence celui des Pays à Faible Revenu (PFR). Nous avons également observé que cette vulnérabilité structurelle affecte la probabilité pour les pays Africains de la Zone Franc de s'engager dans un endettement excessif.

Ainsi, au regard des défis des PED et particulièrement des PFR/Pays Africains de la Zone Franc, il est probable que les expériences répétées de chocs structurels ne faciliteront pas la mise en œuvre de réponse de politique appropriées à ces chocs. Cela tient au fait qu'à la suite d'un choc, la capacité de réponse de ces pays s'affaiblit, ce qui accroît leur vulnérabilité économique structurelle. Dans un tel contexte, les Institutions Internationales telles que la Banque Mondiale et le Fonds Monétaire International (FMI) devront prendre en compte cette vulnérabilité dans l'évaluation des politiques de développement ainsi que leurs recommandations – en particulier sur les questions liées à l'endettement – pour ces pays.

Plusieurs options de politiques économiques pourraient être explorées: une hausse de l'aide internationale (notamment sous forme de dons) et le financement privé, en s'assurant que de tels flux soient gérés de façon à éviter les conséquences macro-économiques fâcheuses, notamment en termes d'endettement. Dans le même temps, la Communauté Internationale devra s'assurer qu'à moyen ou long terme, ces pays réduisent leur dépendance à l'aide internationale puisque tôt ou tard, les flux d'aide s'amenuiseront, telles que le montrent actuellement les conditions économiques des pays développés. Il incombe également à la Communauté internationale de développer des mécanismes susceptibles d'aider ces pays à accroître leur capacité à répondre de façon adéquate aux chocs économiques qui affecteraient leurs économies.

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